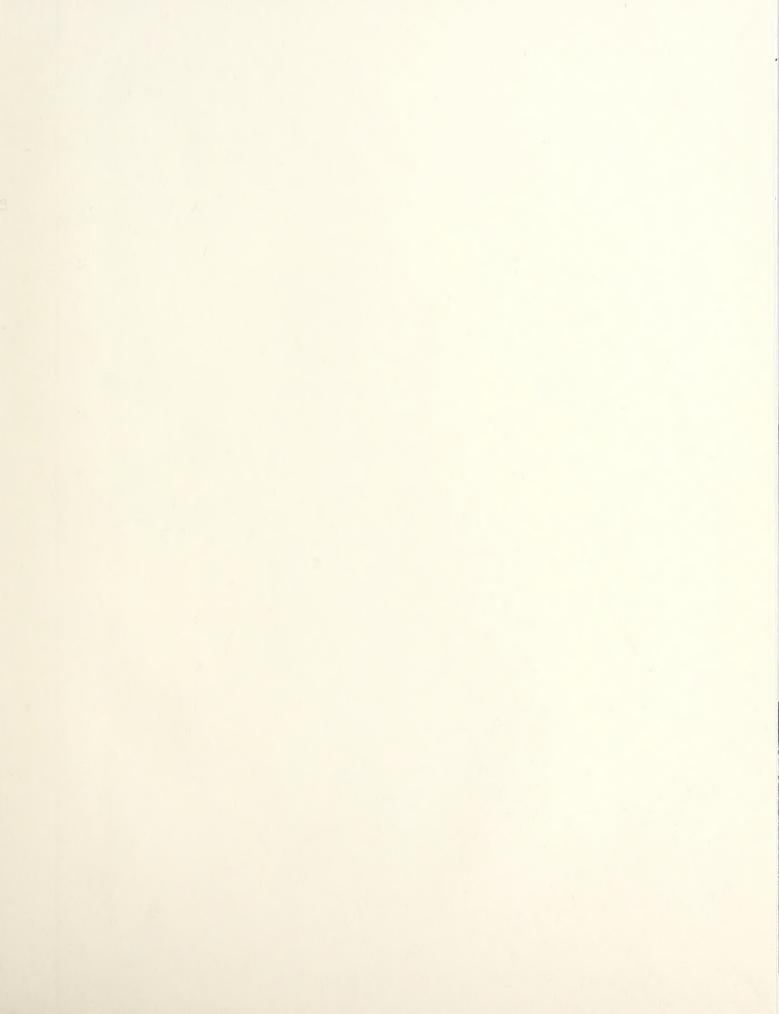


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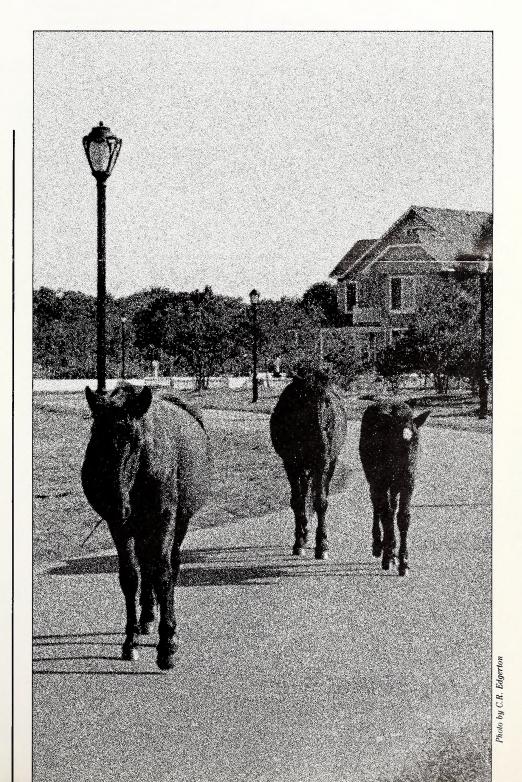
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UNC SEA GRANT

JANUARY 1991

Currituck: The Struggle to Move Ahead and Remain the Same



Will a Bridge Narrow the Gap?

Currituck is a county divided.

Along the banks, planned communities of expensive beach houses line grid streets, forcing conformity on an environment that is otherwise wild and changeable.

Manicured lawns roll up to ornate brick entrance signs that proclaim these suburban outposts—Monteray Shores, Ocean Sands and Corolla Light.

Stores selling T-shirts and tanning lotion are spelled s-h-o-p-p-e-s, and residents are weekenders who have fled crowded northern beaches for the cheaper, more isolated shores of Currituck.

Between these communities are stretches of uninhabited beach and marsh owned by the federal and state government, the National Audubon Society and a remaining hunt club.

Here and there, mostly in the old Corolla village, you'll see an older home without yards of decking, skylights or stained glass portholes. Here, native Currituckers maintain residence on their home sands.

But they are few.

Across the shallow expanse of sound lies mainland Currituck County. Here the

names of communities are simple—Barco, Coinjock, Grandy, Maple and Sligo—names not designed to roll glibly off the tongues of realtors.

Here, communities are marked by green highway signs and clusters of wood-sided houses. Stores are called stores, and neighbors are folks who know your grandmother's name on your father's side.

Here, hunting was a livelihood not a pastime, and ducks were tomorrow's dinner not a mounting on the wall.

They're different, mainland and beachfront Currituck County, as different as homemade and store-bought bread.

And for now, each is isolated from the other

To reach the beaches of Currituck, you can boat across a sound that changes depths faster than a fly changes direction.

Or you can take Highway 158 down the length of the mainland; cross the bridge that spans the tip end of the sound; take Highway 12 north through the Dare County communities of Southern Shores, Duck and Sanderling; and finally reach the Currituck shore.

The trip from Currituck, the county seat, to Corolla, the stopping point for Highway 12, can take an hour or more.

But if you own a house at Swan, North Swan or Carova beaches, then the beach and a low tide offers the only road home.

Two wildlife refuges north of Corolla have denied access through their boundaries and forced residents to consider the beach their link to others.

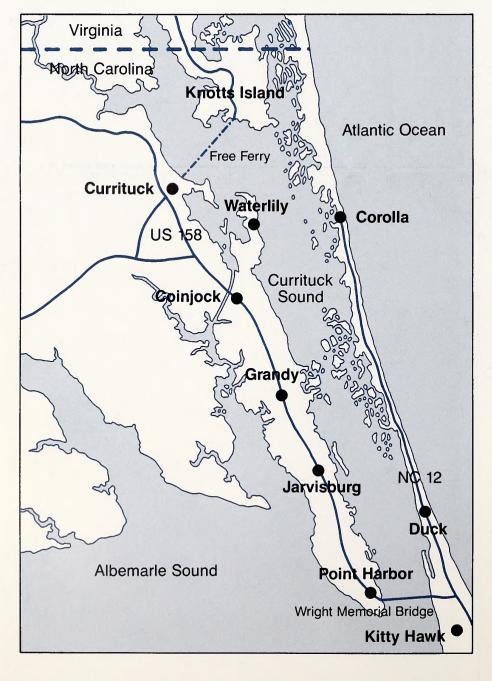
Developers still talk of negotiating an easement through the government property, but most consider the topic moot.

To alleviate some of the problems of access, many in the county and the region would like to marry the beach and the mainland with a bridge that would span the middle of Currituck Sound.

State Senator Marc Basnight, who represents the county, says the bridge is 13 years deep in the state Department of Transportation's long-range plan. Developers and some county residents are pushing for an earlier start.

Many county natives support the bridge, hoping to inject some prosperity into a mainland that can no longer count on clouds of waterfowl and stringers of largemouth bass to sustain it.

Man-made and natural factors have reduced the populations of ducks and fish



that inhabit the sound that brushes the shore at Barry Nelms' soundfront restaurant and hotel in Grandy.

When he bought the place four years ago, hunters and fishermen from across the country booked reservations months in advance.

"In October 1986, we did \$36,000 in business," Nelms says. "This year, I'll be lucky if we do \$8,000."

But if economies are floundering on the mainland, they're booming on the beach.

Property values have appreciated 30 percent a year since the mid 1970s, says developer Larry Riggs. Riggs' father, Samuel N. Riggs, spearheaded much of Currituck's early growth.

"A lot that sold for \$30,000 in 1976 would easily sell for \$175,000 today," Riggs says.

And even at that price, lots are selling like umbrellas on a rainy day to the new rich from Virginia and points north.

"Why not," says Nelms. "They can buy a house and a lot here for what they pay for a lot on the Jersey shore."

And every time the cash register rings up another lot sale, rental or property tax payment, coins drop into county coffers. But so far the county offers little in return, Riggs says.

The isolation of the beach communities and the self-contained style in which they were developed has created little need for services.

But that's changing, Riggs says. With the addition of a health club,

swimming pools and tennis courts and plans for a golf course, realtors are trying to entice year-round residents to the CurAlong the Currituck banks, travel has always been troublesome.

In the 1960s, the road north along the banks stopped in Duck. To reach Corolla, folks had to put their four-wheel drive in gear and bump along a sand "pole road" that ran beneath the power lines.

When it came time to stock supplies, most residents hit the beach at low tide for a ride north to the Virginia communities of Sandbridge and Virginia Beach. But to reach these areas, folks wheeled along Virginia beaches owned by the Back Bay National Wildlife Refuge and False Cape State Park.

That was fine in the early 60s when there weren't too many people making the trip. But when developers started snapping up the Currituck banks, carving it into subdivisions and launching hard-sell advertising campaigns, there were more dune buggies on the beach than ants at a picnic.

Between 1961 and 1971, the number of vehicles trekking across the Back Bay refuge skyrocketed from 10,000 to 348,000 a year.

Concerned about the effect of the traffic on the environment, the Interior Department in 1973 closed the refuge beach to everyone except those with a permit.

To receive a permit today, Currituck banks residents must meet certain boundary stipulations, residency dates, prior access requirements or work needs. The refuge issues about 30 permits, says refuge manager Tony Leger.

Most permit holders are limited to two round trips a day. A few folks, mostly commercial fishermen, have commercial permits that allow them unlimited access, Leger says.

From Oct. 1 until April 30, bankers can make the trip any time of day. But during sea turtle nesting season, everyone must stay off the beach between midnight and 5 a.m.

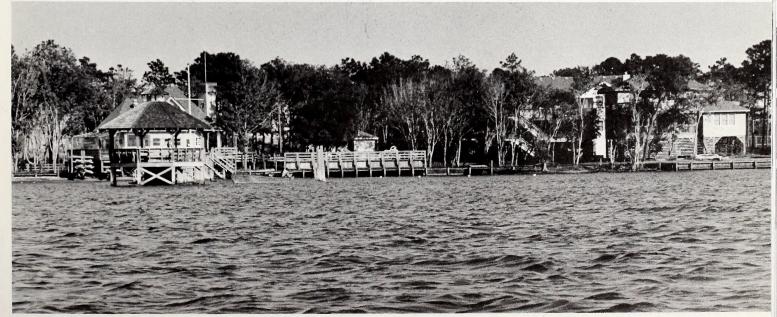
Permit holders cannot sell or transfer their passes to their children if they move away or die. And all permits will be withdrawn if other access, a bridge or ferry for example, becomes available.

Meanwhile, for the hundreds of new banks residents, the only way north is a trip south to Dare County, west over the bridge and finally north up the mainland to Virginia.

rituck banks—residents who would like county services such as water and trash pickup, residents who want quicker access to medical facilities and shopping meccas, residents who want a better evacuation route if a hurricane threatens, residents who want a bridge.

And many mainlanders are just as anxious for a connection. They would welcome the added job possibilities. As it stands now, any labor force needed along the Currituck banks, be it construction

Continued on the next page





workers or shopkeepers, is drawn from Dare County.

"A bridge would be good for all of us," says Norris Austin, the Corolla postmaster and a Currituck native. "It's a golden opportunity to really make employment for the native people.

"Once development has come, I don't see why rural and coastal North Carolina can't jump on the bandwagon," he says.

Others aren't so excited.

Some folks are weary of servicing the rich out-of-staters who live on the beach. They've been catering to the beach folks, acting as maids, cooks, guides and groundskeepers, since the days when the hunt clubs were masters of the banks.

They're dubious of further growth that could turn isolated Currituck County into the hodgepodge of commercial and residential development seen along the Dare County beaches.

Riggs says that won't happen.

"Commercial holdings are probably five percent or less along the beach," says the developer. "We have taken the position to work together for quality development.

"We're selling ocean, sand, beach, hunting, fishing, surfing and sun. We want to maintain a healthy environment."

But some folks don't buy his sales pitch.

"I liked Corolla like it was," says Shirley Austin, a Currituck banks native. "I realize that it couldn't stay that way, and I really thought the development would not go this fast.

"As long as it stayed residential, I didn't

Norris Austin

mind too badly. I don't want to see hotels and motels and all the businesses."

Across the sound in Waterlily and Poplar Branch, mainlanders are worried too. They question the effect the bridge and further development will have on the sound, the waterfowl and the fish that

have meant their livelihood.

For now, Currituck remains divided. Some like it, others don't. But most seem caught—caught between the promise of opportunity and the tug of a heritage founded on ducks, decoys and a shallow sound called Currituck.



oto by C.R. Edgerto

Fishing for Answers in Currituck Sound By C.R. Edgerton

He raises the tip of his fishing rod and, with an experienced flip of the wrist, tosses a Texas-rigged plastic worm into the floating grass.

Jim Easley knows bass fishing among the marsh islands of Currituck Sound isn't what it used to be, but he comes back every year, hoping for a miracle.

The lure flies and the reel zings, breaking the silence of this desolate place. But no fish bites. After a few dozen casts, Easley gives up and moves on.

He laments the decline of the largemouth bass in Currituck and wonders if the right people are doing the right things to maintain the fishery. He wonders just where the problem lies.

"I've been coming here for at least 14 years," he says. "Used to, you could go out there and catch lots of fish in no time, and big ones too. But now, you're lucky to even see one break the water."

Easley, an economist at North Carolina State University, says the largemouth bass fishery means big business to North Carolina. In 1985, the last year figures were available, fishermen spent just under 11 million man-days trying to get largemouth bass to bite.

"That's just over half the total hours spent on all freshwater fishing in the state," he says. "This says something about the role of that critter in attracting fishing for North Carolina."

Jarvisburg native William Wright, a fishing and hunting guide for about 50 years, recalls the last time he or anyone had a great day fishing in Currituck Sound.

"It was the first day of May in 1983," he says. "I remember it so well because we caught 36 fish. But these days, boy it's tight. There haven't been that many fish here in a long time."

Wright doesn't have any pat answers about why the largemouth bass population in Currituck—once one of the most productive in the world—has declined so rapidly. He's no biologist either, but his experience tells him that the primary problem is people.

Back in 1983, 1984 and 1985, fishing pressure was the highest he'd ever seen it. "The fishermen came and they took millions of fish out of here, the breeding ones

included," he says. "And when you take the breeding ones out, they're gone.

"There's some little bass in there," he says. "We've watched the shoreline and seen them. But what we can't see is where they lay their eggs."

He says the sportfishermen aren't entirely to blame. Men who set and drag gill nets for other types of fish catch their share of largemouths. They're required by law to release them, but most of them are damaged and don't survive.

Warren Austin of Barco, who retired from the Coast Guard 12 years ago to work as a fishing and hunting guide, has his own theories about the decline of the bass fishery in Currituck Sound.

"It's dirty water, pollution, pure and simple," he says. "Mankind's destroyed it. There's too much building around the sound. What we need is some salt water to come in here and flush it out and then let the fresh water come back in and start all over again."

But only nature could allow that to happen. "The only way to get an inlet is to have a hurricane open one up," Austin says. "I don't think the state is interested in cutting an inlet into Currituck from the ocean." Every Garden of Eden has its servent.

In Currituck it's the cottonmouth.

"The cottonmouth is about the meanest thing they is," says hunting and fishing guide William Wright. He recently killed a moccasin that measured nine inches around and 67 inches long.

"The local people tell stories of water moccasins chasing people for miles," says one Currituck observer.

But they don't mention snakes when they're trying to sell soundfront property on the banks.

Prospective property buyers don't realize that Currituck is a fresh water sound. It has the appeal of a lake but the soul, and creatures, of a swamp.

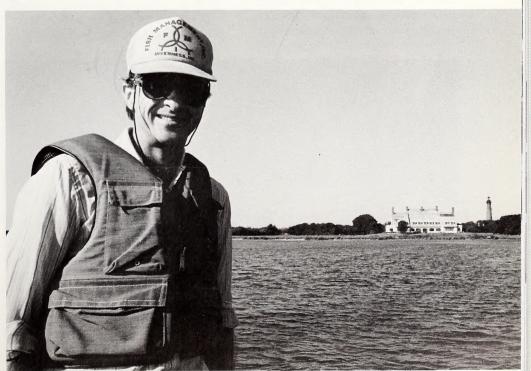
Wright and fellow guide Warren Austin swear to the truth of local snake stories.

Both men say it's not unusual for a water snake to crawl into a boat in the sound.

"The moccasin, she's aggressive," Austin says. "Especially if she's carrying babies."

Mother Nature hasn't allowed salt water to rule in Currituck since 1828. That year, a powerful hurricane grabbed Curri-

Continued on the next page



Jim Easley

Of all the sportsmen who have made the annual pilgrimage to harvest the bass in Currituck Sound, none are so memorable as the West Virginians. By the busloads they came, most from deep in the heart of coal country. "I guess they just wanted to get away from all that mining," says hunting and fishing guide Warren Austin of Barco. "It must feel good to get out of those holes in the ground and come here for some fishing in the open air." The West Virginians enjoyed their Currituck outings to the limit, but they weren't rowdy and didn't demand much from their guides. What they wanted most of all was to catch fish. "A West Virginian, he'd fish in a bathtub, if that's all he had," Austin says. "And when he'd catch them, he'd take them all home with him. "Ain't no telling how many bass them boys took out of this sound." But, like others who once swore by the fishing in Currituck, the West Virginians don't come anymore. "It's because the fishing is down to zilch these days," Warren says. "When the word's out there's no bass, it takes care of itself. We don't have to

tuck Banks, shifted it around a bit and filled in what was then known as New Currituck Inlet. Because the nearest salt water inlet is south at Oregon Inlet, Currituck remains mostly fresh water.

But increased salinity would be disastrous for the sound's bass population, says Pete Kornegay, the N.C. Wildlife Resources Commission's biologist for the 13-county northeast region.

"We had a four-year drought that started in 1984–85," he says. "That reduced the freshwater inflow into the sound and caused salinity to increase."

Extreme high salinity in 1987-88 exceeded the tolerance limits for largemouth bass and other freshwater species in the sound, Kornegay says. Many of the fish died and none spawned.

"And while the water quality in Currituck is good compared to other coastal areas of the state, it's all still a matter of how you look at it," he says. "If you talk to a sportfisherman, he'll say salt water is pollution. If you talk to a commercial fisherman, he'll say fresh water is pollution."

Then there's what Warren Austin calls "real pollution." Over the years, Austin says he's seen lots of raw sewage drain into the sound.

Some of the signs are obvious.

Farmers who cultivate hungry crops such as corn, cabbage and broccoli must pour large amounts of fertilizer into the soil. The natural leaching process carries nutrient-laden runoff into the creeks and rivers that eventually end up in the sound.

In extreme cases, swine farmers have allowed water from their waste lagoons to

empty directly into the Currituck drainage basin.

But whether or not the waters in Currituck Sound are polluted or whether they're salt or fresh isn't all of the problem, says UNC Sea Grant Director B.J. Copeland.

Copeland is co-author of a recent report on the status of the Albemarle-Pamlico estuary.

He agrees that the decline of the bass fishery can be traced to slight changes in the water's salt content. But other factors include changes in the sound's water movements and in the abundance of underwater grasses.

"And let's not forget overfishing," says Copeland. "All these things have happened over a period of the last 20 years."

Copeland says the sound's primary problem can be traced to a canal that connects the North Landing River to Virginia Beach. "This canal, built for flood control, transports wastes from Virginia Beach," he says. "The net flow goes into Currituck."

Over the last two decades, these pollutants, along with farm runoff and the residues of overdeveloped shorelines, have poisoned the sound and its plants and animals.

"The solution, then, is to reduce those inputs," Copeland says. "If we can get rid of the Virginia stuff, and be careful about watershed development in Currituck County, then the sound would clear itself up. Nature is very resilient."

Meanwhile, the state is continuing its efforts to revive the sound's largemouth bass population. In 1989, when salinity levels had dropped drastically, more than 60,000 bass fingerlings were released.

And, beginning this year, the size limit on bass taken from Currituck rose from 12 to 14 inches. Also, the Wildlife Commission is proposing to change the statewide creel limit from eight to five largemouth bass per day.

Whatever the solutions, they won't come easy. The constant pressures of developers, politicians, sportsmen and vacationers will continue to play important roles in Currituck Sound's recovery.

For the people whose livelihoods have always depended on the fish and fowl taken from Currituck, the future doesn't seem as bright as the past.

"Bass fishing just don't get it anymore in Currituck," Warren Austin says. "I turned down a party this month because I didn't think he'd do any good out there, and I'd hate to take his money knowing that." •



advertise."

to bu Joel Arrington

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.



Just how important is Sea Grant research? Ask U.S. Secretary of Agriculture Clayton Yeutter. He recently gave the Department of Agriculture's

prestigious Superior Service Award to three Sea Grant researchers.

J. Wendell Gilliam, Wayne Skaggs, and Robert O. Evans—all scientists at North Carolina State University—were recognized for their contributions to agriculture.

Sea Grant funded the prize-winning project. It focuses on how farmers can reduce the amount of nitrogen lost through the soil. And, since those nutrients usually leach into rivers and streams that eventually find their way to the Tar Heel coast, the team studied how estuaries are affected by the excess fertilizer.

The men conducted their research on a coastal North Carolina farm and then devised recommendations for better managing farm runoff. As a result of their study and other needs, the N.C. General Assembly enacted a cost-sharing program to entice farmers to follow the recommendations.

"The program is working so well that three other states—Maryland, Delaware and Virginia—also require these better management practices in their cost-sharing programs," says UNC Sea Grant Director B.J. Copeland.

"The award from the Department of Agriculture proves that Sea Grant scientists are tops when it comes to assuring that our coastal resources are used wisely," Copeland says. Have you decided aquaculture is the wave of the future? Then Sea Grant has a new publication for you.

Raising Hybrid Striped Bass in Ponds, by Ron Hodson and Jennifer Jarvis, is a manual that provides step-by-step procedures for producing market-size hybrids.

Commercial catch of striped bass has sharply declined in recent years, leaving a void in the seafood market. But the hybrid, which is a cross between striped bass and white bass, fills that void with an even better fish—one that grows faster and is hardier.

UNC Sea Grant has put 10 years of research into developing the hybrid, and the National Coastal Resources Research and Development Institute funded the first commercial culture of the hybrids.

Now the results of both projects are available in this new manual.

Hodson and Jarvis describe how to collect broodstock, cross-fertilize the eggs, manage the larvae and tend the fingerlings. They include information about feed, diseases, pond structure, equipment and marketing. And they provide tables for determining the economics of raising the hybrids.

For a copy of this manual, write Sea Grant. Ask for UNC-SG-90-05. The cost is \$5 plus \$1 for postage and handling.

If you've ever wondered who eats seafood, what types they prefer and why they change their eating habits, then Sea Grant researchers have some answers for you.

David Griffith and Jeff Johnson, two East Carolina University anthropologists, along with Jim Murray and Skip Kemp of the Marine Advisory Service, surveyed consumers in the Southeast about their seafood preferences.

The resulting information has been compiled into an easy-to-read illustrated booklet, *Getting to Know Southeast Seafood Consumers*.

Designed for use by seafood retailers, wholesalers and processors, the illustrated booklet strives to help businessmen develop an understanding of the complexity of factors affecting seafood choices.

Practical matters like price, ease of preparation and availability certainly affect food decisions. Yet a person's experiences, lifestyle, phase in life and traditions also influence the foods they purchase and eat.

For a copy of *Getting to Know Southeast Seafood Consumers*, write UNC Sea Grant. Ask for UNC-SG-90-04. It's free, but please enclose \$1 for postage and handling.



If you grow and harvest shellfish on estuarine bottomland leased from the state, you'll want to attend Sea Grant's annual shellfish conference.

The workshop is scheduled for February 16 at the Duke University Marine Lab in Beaufort.

This year's conference is designed as a training session primarily for leaseholders, but offers information for those who are interested in obtaining first-time leases.

Sea Grant Marine Advisory agent Skip Kemp will lead the one-day workshop, which will focus on how to write shellfish management plans, the ecology and biology of shellfish, relaying shellfish from seed areas and polluted waters, extensive and intensive production of oysters and clams, and marketing and promotion.

As usual, the conference will end with a question-and-answer session and a social hour. A \$20 registration fee will cover all materials and the social.

Among the speakers for this year's workshop are Tom Ellis of the N.C. Department of Agriculture, N.C. Representative Robert Grady and Bill Hogarth of the N.C. Division of Marine Fisheries.

For more information, contact Skip Kemp at 919/247-4007.



Rolling, sunlit waves and a gentle breeze on the face.

These pleasant sensations of nature prompted coastal property owners to

build their castles in the sand.

But angry winds and crashing waves

can spoil the mood fast.

When damage occurs, insurance pays off for some property owners. But flood insurance can be costly. For some, it's prohibitive.

Sea Grant's booklet Saving Money on Flood Insurance for Coastal Property Owners can help.

It identifies construction choices in new buildings, existing building modifications and insurance rating options that can reduce the annual cost of flood insurance.

With the assistance of an insurance agent, the guidelines should help a prospective builder, existing owner or designer to optimize the building for the lowest desirable flood insurance premium.

The booklet was written by Sea Grant coastal engineer Spencer Rogers.

For your copy, send \$1 to UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695, and ask for publication number UNC-SG-89-05.

Next June, Tar Heel science teachers will have two opportunities to learn first-hand about the state's estuarine environment.

Approximately 15 teachers are needed to serve as trainers-facilitators for *Project Estuary*. A facilitator institute June 24–28 will examine characteristics of estuaries, activities to teach coastal ecology and field experiences for students.

Participants will go birdwatching, seining

for fish, hiking in maritime forests and travel aboard the Duke Marine Lab research vessel to Carrot Island and Cape Lookout.

Another June program, "Paddle to the Sea," will provide in-service training to 20 science teachers from a target area including Tyrrell, Hyde, Dare and Washington counties.

Selected participants will examine the Albemarle Sound watershed and study coastal education materials. They'll canoe on Lake Phelps and the Scuppernong River and survey Oregon Inlet from a headboat.

For more information about "Paddle to the Sea," call Lundie Spence, Sea Grant's marine education specialist, at 919/737-2454. Or request an application from UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695.

For applications for the *Project Estuary* workshop, write Gail Jones, Assistant Professor, University of North Carolina, Chapel Hill, N.C. 27599-3500. Or call the UNC Mathematics and Science Education Center at 919/966-5922.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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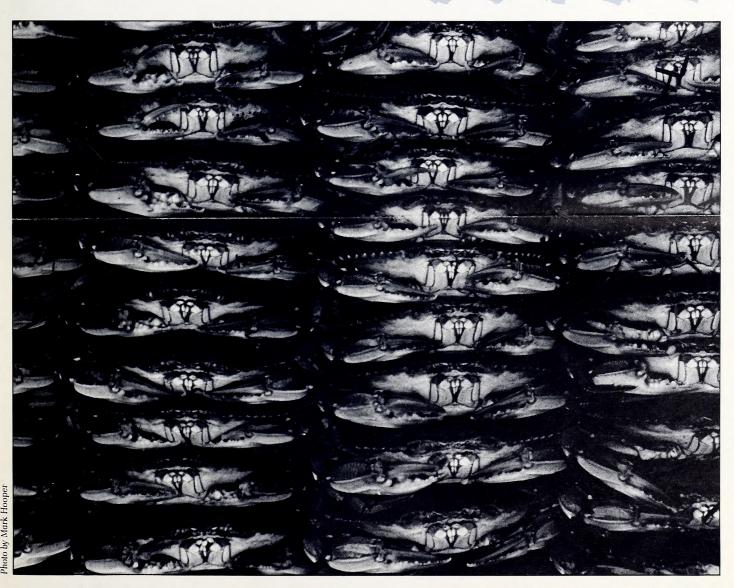
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FEBRUARY 1991



Seafood Safety: An Issue For The '90s

A Stamp of Approval for Tomorrow's Seafood

By Kathy Hart



HACCP.

It's one of those bureaucratic acronyms that doesn't tell you anything but means a lot.

It's being volleyed about in Congress and analyzed in university food science departments. In the seafood industry, it's applauded, dreaded and misunderstood.

The letters stand for hazard analysis critical control point, an awkward phrase that doesn't mean more than its acronym.

Translated into everyday English, HACCP is the mandatory inspection program being proposed for the U.S. seafood industry.

Consumer advocate groups from coast to coast have urged their congressmen to pass legislation that would mandate an inspection program for the seafood industry comparable to that used for red meat and poultry.

As demand for fish and shellfish has spiraled upward, so has concern about seafood safety and public health. The media has focused increasing attention on pollution in our coastal waters. And consumers adding one and one to get two have surmised that the catch harvested

from these waters may not be as safe as they'd like.

But their addition may be faulty, says Donn Ward, a seafood extension specialist with the North Carolina State University Department of Food Science.

He says seafood safety problems may be more a problem of perception than reality.

Just over 20 percent of all food-borne illnesses reported to the national Centers for Disease Control between 1973 and 1987 were attributed to seafood.

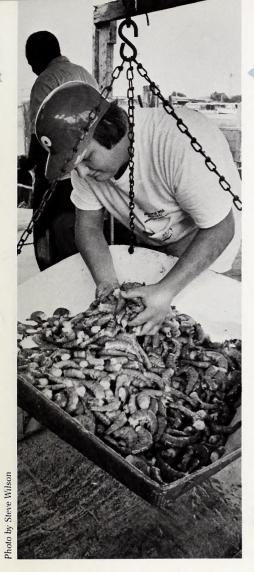
But after you adjust for per capita consumption and omit sicknesses related to consumption of raw shellfish, the number of illnesses drops to 25 percent below that for poultry and only slightly more than that for beef.

And even these figures may be too high because they include illnesses caused by fish caught recreationally, Ward says.

"You don't stop on the side of the road, shoot a cow, haul it home, clean it and cook it," he says. "But a lot of people do catch their own fish and shellfish, and often they mishandle it."

Illnesses caused by this mishandling





Oil spills in Alaska. Syringes on New Jersey beaches. Fishless water in Boston Harbor.

Consumers are getting the message from Dan Rather to Phil Donahue that our coastal waters are polluted.

Is this talk of pollution affecting people's perception of the fish and shellfish caught in these waters?

Maybe, say Sea Grant researchers David Griffith and Jeff Johnson. These East Carolina University anthropologists are determining what people know about coastal pollution and how it affects their seafood buying and eating habits.

Griffith and Johnson have surveyed consumers in several states and across North Carolina to see if geography, age, education or race play factors in people's knowledge about coastal pollution and

what they think of the fish and shellfish harvested from these waters.

Johnson says some people glean information from the morning newspaper. But others' ideas are based on folk theories or individual assumptions.

The team is just beginning to analyze its findings from more than 150 interviews. Now they're tracking 30 people with monthly telephone surveys to see if information they read or see—be it from Dan Rather or their next door neighbor—is affecting their eating habits.

When their study is complete, Griffith and Johnson will advise the seafood industry about educating its consumers. Armed with the right information and approach, the seafood industry can calm any fears the American public has about the seafood it eats.

Photo by National Fisheries Institute



of recreational fish are lumped in government statistics with those resulting from commercially handled seafood. As a result, the seafood industry may be getting a bad rap it doesn't deserve. "I'm not saying the seafood industry

"I'm not saying the seafood industry doesn't have problems with illnesses because it does," Ward says. "But the public's perception is that there are more problems than actual evidence shows."

And these aren't the only wrong ideas Americans have about seafood safety.

"The public has the impression that seafood processors are not inspected now," Ward says. "They are inspected. It's just not continuous inspection like we have for meat and poultry."

The Food and Drug Administration inspects all food, including fish and shellfish, that crosses state lines. They periodically visit seafood businesses to inspect plant sanitation.

The Environmental Protection Agency monitors coastal water quality, establishes allowable limits for specific toxins and tests fishery products. The U.S. Fish and Wildlife Service does the same for inland fish.

On the state level, the N.C. Department of Agriculture inspects finfish facilities; the N.C. Division of Shellfish Sanitation, shellfish and their harvesting waters. And some county governments also scrutinize the fishermen's catch.

But all this inspection doesn't impress consumer advocacy groups.

They say that the present system focuses on plant sanitation not product safety, it's confusing and it's geared more for large processors than Mom and Pop operations.

To answer the public's call for better

Continued on the next page

inspection, congressmen have introduced no less than nine mandatory seafood inspection bills in the last few years.

None have passed.

Two major controversies are preventing passage, Ward says. First, Congress can't decide which federal agency should administer the inspection program. Some feel it should be under the auspices of the FDA; others vote for the U.S. Department of Agriculture.

And then there's the question of who pays for the inspection.

Some believe industry should foot the bill to ensure its own product safety; others say the seafood industry should be treated just like the red meat and poultry industries. The inspection in their plants is paid for by federally appropriated funds.

If Congress can resolve these two sticking points, then seafood may soon be inspected from the boat to the consumer.

And regardless of which agency regulates the program or who pays for it, seafood inspection will be based on the HACCP inspection method.

This method identifies the points, or hazards, during processing when seafood could become contaminated. These critical points would then be monitored to ensure that processing and handling procedures are safe and under control.

Each seafood processing plant, be it large or small, would develop a HACCP plan based on the types of fish and shell-fish it handles, its equipment and its operating procedure. Once the plan received federal approval, then the plant would have to keep detailed records about its monitoring of the critical control points.

Ward says compliance with a HACCP plan should mean three things for American consumers. It should ensure public health and plant sanitation. It should also stop fraudulent activities such as purposely mislabeling a low-priced species as a higher priced one.

Although HACCP will have a big impact in the United States, its effects will also be felt abroad. American processors told Congress if U.S. products had to meet rigorous standards then imported

products should receive similar scrutiny.

Congress listened, and its proposed legislation requires seafood entering the United States to be bought only from companies that use an inspection method equivalent to HACCP.

American processors are divided on the issue of mandatory inspection. Many favor the program as a way to restore consumer confidence. Others feel it calls for too much government intervention.

Many just don't yet understand its concepts and complexities, Ward says.

But whether the seafood industry likes it or not, mandatory seafood inspection is the wave of the future.

"It's no longer a matter of if, it's a matter of when," Ward says.

"If consumers think seafood inspection is going to significantly reduce seafood-borne illnesses, then they may be disappointed. Illnesses associated with seafood are not a large problem now. But what they will notice is an improvement in the quality of the fish and shellfish they buy."

Inspection Plan Gets Mixed Reviews

By C.R. Edgerton

If you want to know crab meat, ask Jimmy Johnson.

As plant manager for the Washington Crab Company in Washington, N.C., he oversees the handling of about 14,000 pounds of crab meat per day.

Before shipping it to northern markets, Johnson makes sure the meat is picked and packaged in a safe, clean environment. Doing it any other way, he says, would put his company out of business.

Although he has misgivings about governmental intervention in an industry that has traditionally thrived on independence, he says he's not afraid of what federal inspections by the HACCP method might mean to his business.

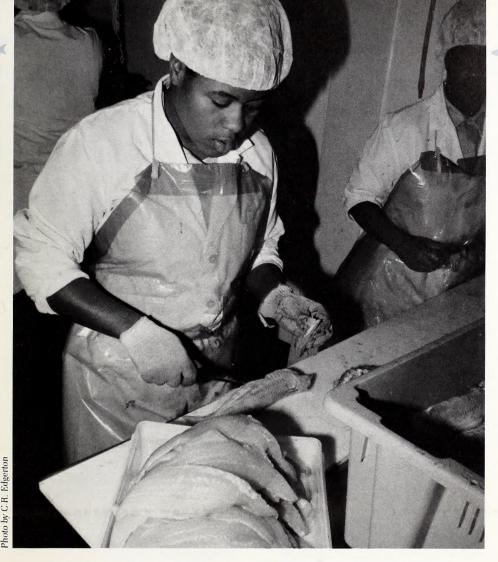
He's already made sure his factory meets certain guidelines for sanitation as imposed by agencies such as the state's Department of Environment, Health and Natural Resources and the federal Food and Drug Administration.

"Our plant is inspected on a regular basis," he says. "We're open to any type of inspection that they may wish to do."

Johnson says inspectors routinely sample his products (mostly crab meat with



Photo by C.R. Edgerton



some whole fish) and test them for bacteriological problems.

"We're also checked for cleanliness, sanitary practices and the physical condition of our plant, right down to the covers on our lightbulbs." he says.

Although current inspections are not as time-consuming or as thorough as those that would be mandated by a federally imposed HACCP system, Johnson believes they are sufficient.

"We don't need inspectors who come into our plant on a daily basis like they do in beef or poultry plants," he says. "Visual inspection of our product just won't work in a seafood market. It would be better for them to just come around now and then."

Johnson says he isn't convinced that seafood processors should be so closely scrutinized anyway.

"I'm not convinced that we need it," he says. "The push for HACCP is coming from consumer advocates and from huge seafood processors who stand to gain more business if the image of seafood is made more positive."

The media has not helped, he says.

"The consumer is wary of seafood because the industry hasn't come out against the biased accounts about seafood we see in the media. We're like ostriches with our heads in the sand. We haven't done much about it, hoping it'll go away."

Case in point: the red tide scare of two years ago.

"The red tide only affected a small area of our coast and only a very small amount of seafood," he says. "But during that time, you couldn't give North Carolina seafood away. The media blew the whole thing out of proportion."

More positive media reports could be one outgrowth of the proposed HACCP inspections, says North Carolina State University food scientist Donn Ward, head of a national committee charged with developing courses and materials for training seafood processors in the HACCP method.

"The tragedy is that people think seafood plants are not inspected at all," Ward says. "It's totally erroneous for them to assume that."

Ward says all seafood processing plants are regularly inspected by state and federal

agencies. HACCP will bring changes only in the method of inspection.

The more complicated techniques of HACCP inspections will create a need for educating seafood processors. The federal government will strongly urge that processors undergo HACCP training, although it won't be mandatory.

The training will include a two- or three-day educational program written on a high-school level. There will be a final exam and participants will be expected to maintain a certain level of competence.

Those who pass the exam will be given a certificate of completion by the National Fisheries Institute, sponsors of the training program.

"Mere attendance in this program will not mean a thorough understanding of HACCP;" Ward says. "It will require some study and work. For some, this type of training will be absolutely essential just to help them understand the inspection program."

Ward predicts mixed reactions from seafood processors, some of whom will not accept the government's intervention in their businesses.

Jimmy Johnson says his company will welcome the new methods and the training. But he still feels HACCP will be more of a hardship than a help for small and family-owned processing plants.

"Our paperwork will probably triple and that will require more man hours, which will cost more," he says.

Some processors, especially those that have remained very small or are working in outdated buildings with antiquated equipment, may be forced out of business by the new inspection regulations.

"It's going to be a necessary evil, like a steam roller that you can't stop," Johnson says. "It will drive up the cost of operating and will narrow even more an already extremely narrow profit margin."

Johnson says his company will "easily comply" with HACCP inspections. And he expects the government to force foreign processors to comply under the same guidelines as American companies.

If HACCP inspections come, as they surely will, Johnson realizes that he and other small North Carolina seafood processors will have to adhere or go out of business.

"It's coming." he says. "We'll have to grin and bear it, and just hope for the best."

Handling Seafood Safely at Home

By Carla B. Burgess

The responsibility for seafood quality and safety doesn't end at the grocery store or at the processing plant.

It carries over into our own kitchens and what we do there.

Sea Grant's seafood education specialist Joyce Taylor offers some tips on how to ensure a top-notch meal.

"The most important consideration in handling seafood at home is just plain old cleanliness," says Taylor.

Follow these guidelines during seafood preparation to assure sanitation:

- Wash hands frequently with soap and warm water before working with a new food or utensil.
- Prevent cross-contamination; never let raw seafood come in contact with cooked food. Use a clean cloth or paper towels while cooking.
- Use an acrylic cutting board, never a wooden one.
- Wash boards, counters and all utensils in detergent and hot water.
- Thaw frozen seafood overnight in refrigerator or under cold running water. Never let seafood thaw at room temperature.
- Don't leave cooked seafood out on the counter too long. Store in the refrigerator within two hours of cooking.

Some harmful substances in raw seafood—such as parasites—are eliminated by cooking.

Salmonella, a bacteria that can cause food poisoning, is also killed through proper cooking.

But suppose you like to fish for your supper?

Then from the nibble on the end of



your line to the delectable morsel on the end of your fork, you've got to be prepared.

"I always tell people to ice fish the minute you get them out of the water," Taylor says. "You can't ice them too soon."

Take special precautions with species such as tuna and mackerel, where improper handling can cause more than spoilage. If these species heat up, they can cause an allergic reaction that no amount of cooking will prevent.

Taylor recommends dressing these fish immediately, or at least heading, gutting and rinsing them before icing them down.

Superchilling, a combination of ice and salt in a cooler, is a good method for storing fresh fish when you're going to be out a few days.

It's not uncommon to see people fishing all day on a beach or pier while the three or four fish they've caught lie in a bucket of water beside them. Then they wonder why their fish aren't pleasing to the palate.

"They had cooked them in that bucket before they took them home is why," Taylor says.

"A lot of fish, if poorly handled, are not going to make you sick," she says. "They're just going to taste bad."

To learn more about how to properly handle, prepare, transport and store fresh fish, write Sea Grant for a copy of Bringing the Catch Home, publication UNCSG-86-26. The brochure costs 50 cents.



Photo by The Charlotte Observer

Seafood-borne diseases most often fall into one of three categories.

Raw molluscan shellfish—Shellfish harvested from water contaminated with harmful bacteria and viruses can transfer these diseases to consumers if the shellfish are eaten raw or partially cooked.

Runoff from farms and cities, malfunctioning septic tanks and poor sewage treatment facilities are all causes of contamination. In North Carolina, the Division of Shellfish Sanitation monitors our waters to detect bacteria that indicate the presence of harmful viruses.

If bacteria levels are high, then waters are closed to shellfishing. Currently, oysters and clams cannot be harvested from 370,081 coastal acres to protect public health

Shellfish harvested from contaminated waters can carry gastrointestinal viruses and hepatitis.

Scombroid poisoning—Species such as tuna, mackerel and bonito have high levels of an amino acid called histidine in their bodies. If, after harvesting, these fish are not iced and kept cool, the histidine breaks down through bacterial action to become histamines that can cause an allergic reaction for consumers.

The reaction can include sweating, a peppery sensation around the mouth, dizziness, nausea and diarrhea. The discomfort usually lasts four to six hours.

Cooking the fish will not prevent the reaction.

Ciguatera—This problem is restricted to tropical fish. It is a toxin that begins with a dinoflagellate bloom around reefs and is passed up the tropical food chain.

The toxin is not detectable by taste, smell or sight.

The onset of the symptoms of this toxin occur rapidly. They are nausea, vomiting, headache, a tingling in the mouth and throat, and a reversal of hot and cold sensitivity.

If you exhibit any of these symptoms and think they are being caused by eating tainted seafood, call your doctor or hospital immediately.

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU. Raleigh. N.C. 27695-8605.



North Carolina clams are big business. In 1986, the hard-shelled mollusks accounted for \$7.5 million in income to North Carolina.

That money was earned

mostly by part-time clammers who picked a site at random and waded into kneedeep water with bull rakes and floating wash tubs.

But there's a better way.

Sea Grant's newest publication will show you how to get your fair share of the Tar Heel clam pie.

Clam Gardening: A Manual for the Small-Scale Clam Operation in North Carolina focuses on how to lease a clam gardening site, plant seed clams, and harvest and market the mature crop.

Marine Advisory agent Skip Kemp wrote the manual based on his own research and his extensive experience working with successful clam gardeners up and down the Tar Heel coast.

"This manual is geared for the average person who wants to start his or her own clam gardening operation in estuarine bottomland leased from the state," Kemp says. "It's a book anyone can use."

The 36-page manual includes how-to drawings and photographs and lists companies that can supply the necessary equipment. Several tables and charts illustrate what the clam gardener can expect from an average crop.

For your copy of the manual, send \$5 to UNC Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Ask for publication UNC-SG-91-02.



The 1991 North Carolina Commercial Fishing Show is right around the corner—March 9–10.

The show will feature exhibits and sales of items

used in commercial fishing, such as boats, engines, nets, hydraulics, electronics and more

Sponsored by the Carteret County Watermen's Association, the show will be held at the Crystal Coast Civic Center, 3505 Arendell St., Morehead City. Show-times are 9 a.m. to 6 p.m. March 9 and 10 a.m. to 5 p.m. March 10. Admission is free.

NASA will have its SARSAT (Search and Rescue Satellite) van on exhibit. This system, used by Emergency Position-Indicating Radio Beacons (EPIRBs), will be explained and demonstrated.

A series of seminars sponsored by Sea Grant will be offered to watermen during the two-day event. Topics include: "Crab Shedding as a Commercial Venture," "Shellfish Culture as a Commercial Venture," "Dioxin in North Carolina Waters," "Seafood Safety and Inspection Legislation and the Fisherman," and "TEDs in North Carolina—What Do We Expect in 1991?"

For a schedule of the seminars, contact Sea Grant marine agent Bob Hines at 919/247-4007.



Would you like to know more about how to preserve and protect North Carolina's coastal resources? If so, the third annual

If so, the third annual Coastal Celebration prom-

ises to offer entertaining and educational answers to your questions. This unique two-day festival focuses on what individuals can do to conserve coastal resources.

The celebration is set for April 13–14 in the Kerr Scott Building at the North Carolina State Fairgrounds in Raleigh. The theme for 1991 is "Our Past, Our Future." Admission is free.

The event will include demonstrations of trades such as boat building, model boat construction, net making and mending, oyster shucking and decoy carving. Also back this year will be traditional music and dance, coastal folklore, storytelling and scrumptious seafood.

Last year's celebration drew more than 15,000 people.

A new attraction is the Educational Resources Room, which will feature panel discussions, slide presentations, demonstrations, lectures and other programs designed to educate adults and young conservationists.

The event is part of WRAL-TV's Save Our Sounds project. Co-sponsors include the North Carolina Coastal Federation and other non-profit and governmental organizations.

Sea Grant and The Big Sweep will be among the exhibits included. We hope to see you there!

When it comes to getting a good buy and the freshest fish at the seafood counter, it pays to know what's in season.

Sea Grant has a seafood poster that colorfully charts the availability by month of North Carolina's most popular fish and shellfish species.

At a glance, the 23-by-17 inch poster can tell you when Tar Heel fishermen are harvesting bluefish, flounder, king mackerel, snapper, shrimp and clams. For example, you'll know that February is a good month to buy sea bass, gray trout and porgies, but in July you'll want to fill your grocery bags with shrimp, croaker and hard crabs.

Using the chart should help you plan meals, get better buys and choose the freshest fish and shellfish.

The chart was compiled by Sea Grant's seafood education specialist Joyce Taylor. It's based on North Carolina commercial landing statistics.

If you'd like to hang this seafood availability chart in your kitchen, write Sea Grant. Ask for UNC-SG-84-04. The cost is \$2.

Coastwatch

UNC Sea Grant is soliciting research proposals for the 1992–1993 funding period. If you're a researcher and would like to submit a proposal, call the Sea Grant office in Raleigh or consult the "Call for Proposals" memorandum available at

Name.

the research office of your university.
All proposals must be submitted by
April 4.

The Big Sweep is proud again! Big Sweep '90 has been named a statewide winner in North Carolina's 1990 Take Pride in America awards program. The program recognizes outstanding stewardship efforts involving public land.

Winners in the statewide program automatically become nominees for a national Take Pride in America award.

North Carolina's waterway cleanup, which takes place each fall, has won three national awards. This is Big Sweep's fourth state award.

The Big Sweep is organized by UNC Sea Grant, other state agencies, corporations and volunteers.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 18, No. 2, February 1991. Dr. B.J. Copeland, director. Kathy Hart, editor. C.R. Edgerton and Carla B. Burgess, staff writers.

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Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out

this form and send it to Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

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UNC SEA GRANT

MARCH 1991

Who Will Be Tomorrow's Scientists?



Lewer Choose Science Women and Minorities to Give Science

By Carla B. Burgess

Where would the world be without scientists?

Without someone to lead us in discovery, we'd probably still be rubbing sticks together to make fire and dying from smallpox and polio. We would never have set foot on the moon or sunk to the depths of the ocean floor.

From Isaac Newton to Marie Curie to Albert Einstein, scientists have forged discoveries that saved lives, increased our comfort and broadened our concept of the universe.

Although these heroes of discovery are applauded and admired, fewer people are choosing to dedicate their lives to research. The feet to fill the scientific shoes of tomorrow are running in other career directions at a time when we need them most.

The National Science Foundation predicts a shortfall of 675,000 scientists and engineers in the United States by 2006. Not only will there be fewer researchers in the field, but fewer Ph.D.s to lecture in college classrooms.

When it comes to tackling the major scientific problems looming on the horizon—global warming, restoring rain forests, salvaging water quality, restoring fish stocks—scientists may be in short supply.

Sea Grant invests in our scientific future by awarding graduate fellowships, internships and opportunities to study under the guidance of researchers doing Sea Grant work. But these efforts may be a drop in the proverbial scientific bucket.

The forecast for tomorrow includes a retirement wave among aging scientists and university professors, potentially magnifying the deficit of researchers.

To fill the void, educators and employ-

ers are looking to women and minorities, who have traditionally not pursued careers in biology, oceanography, biotechnology and engineering.

By the end of this century, 85 percent of people entering the job market will be minorities and women.

Demographics suggest that the American population over the next several decades will include a higher proportion of blacks, Hispanics, women and other minorities. In North Carolina, minorities already represent 25 percent of the population.

"A percentage of them need to be represented in the sciences. And we can't improve in the future if they aren't even in the field now," says Sea Grant marine education specialist Lundie Spence.

Over the past 20 years, women's participation in science and engineering has increased so that they now earn 45 percent of the bachelor's degrees and 30 percent of the Ph.D.s in those fields.

But this slow rise has offset a decline in male participation. Also, the number of female science majors has not increased proportionately with the increase of women going to college.

A federal report concludes that this slowdown is happening because women continue to experience higher unemployment, lower pay and fewer promotion opportunities than their male counterparts.

The situation for blacks is even bleaker. They represent 11 percent of the working-age population, but earn only 1 percent of all doctoral degrees in natural sciences and engineering.

Many people are starting to recognize this untapped pool of talent. There are several programs aimed at attracting these groups.

But saving science will require more than just recruiting people into a program. Students need to be kept there and nurtured until they're placed in a science career.

"Any program to bring in minorities and women has got to be considered a long-term one," says Spence.

That's called "sustainable education," says Walter "Skip" Bollenbacher, a University of North Carolina professor who has developed a model outreach program for the advancement of minorities in science. (See story, page 5)

"There's a problem with the way we're trying to solve problems with science education," says Bollenbacher. "As a society, we always go for the quick fix."

The tendency of social programs to throw money at a problem is temporarily effective at best. "Some people feel they need a more immediate return to their investment," he says.

Bollenbacher's program deals with students and teachers at the high school and college levels. It's an ongoing program to "energize" science education and attract minorities to science careers.

Here are some other programs going on in North Carolina:

The Duke Young Scholars Program—Selected female, middle-school students spend five weeks in a summer enrichment program at the Duke University Marine Lab in Beaufort, collecting specimens and doing research.

"This is definitely the time to start encouraging minorities and women to go into science," says Joan Barber, the program's co-director.

Barber, who did full-time research in renal physiology before accepting her

Careers: Encouraged ea Chance

current position, says some young girls she meets think a career in science is so far out of reach.

"Their tone is always as if there's something magical about it," she says.

The Sloan-North Carolina School of Science and Mathematics Initiative—Sloan is an ongoing two-year program that targets five rural counties in North Carolina.

The 120 participants are blacks and American Indians who are exposed to enrichment programs and school-based mentor programs, says Joan Barber, who is also the Sloan project director and deputy director of student life at NCSSM.

"I call it raising their horizons," she says of the program's goals. "We give them knowledge about what's available to them and start them off at an early enough age to get them on track."

Ideally, the program will create a pool of NCSSM hopefuls, she says.

Math-Science Education Network Precollege Program—This statewide program tracks minorities and women from sixth through 12th grade in an effort to steer them toward careers in math and science, says North Carolina State University campus coordinator Carolyn Collier.

The program received seed money from Sea Grant for some of its preliminary conferences.

The program includes Saturday classes, a summer scholars curriculum and role-model interaction. About 200 Wake County students are enrolled.

Participants learn math, science and communication skills and an emphasis is placed on cultural awareness.

"We're dealing with developing the whole child," says Collier.



If Skip Bollenbacher had a grant to do it, he'd start reforming science education as early as kindergarten.

Because to attract anyone—black or white, male or female—to science, there needs to be a change in the way we teach it from day one, says the UNC biology professor.

"We have succeeded in eroding the intrinsic interest children have in science," he says. "You grow up loving worms, playing in ponds."

But soon the memorize-regurgitate syndrome of learning starts. And by the time most students are in the 10th grade, they're sick of it all, he says.

"They need less facts and more meaning," Bollenbacher says. "Students need to be taught at a conceptual level."

The universal complaint from young students—"Why do I need to know this?"—is finally being heard loud and clear throughout classrooms.

A five-year-old needs to learn science—



Lundie Spence

Photo by Allen Weiss

or any other subject—as it relates to him or her, says Bollenbacher. "We have to train teachers to make things interesting and relevant," he says.

"This is one of the new trends in science education—the idea of relevance," says Sea Grant marine education specialist Lundie Spence. "In a 10th grade science class, students may learn 3,000 new words that are never used again."

A program funded by the National Science Foundation is aiming to change the way science is taught in the middlegrades, she says.

"They're trying to get away from the layer-cake science curriculum," says Spence, explaining that schools have a tendency to serve up physics, biology, chemistry and geology with no regard to how they relate.

"The goal is to integrate science from a very applied, personal level," she says.

Students need to be scientifically literate, whether they plan to become scientists or not.

"The question we're concerned with is—Who can be a good citizen, who can understand science?—whether it has to do with health insurance, wetlands protection or new technology," Spence says.

But reform will take time, and the solutions are never a sure thing.

"And for all of the experts and educational leaders, it won't work without mothers and fathers taking an interest in their children's education," Spence says. "It doesn't matter what the schools do if there's no support at home."

Succeeding in a Man's World

By C.R. Edgerton

A scientist is a frizzy-haired caucasian man in a bleached lab coat hovering over a beaker of bubbling liquid, right?

Wrong, except that most working scientists are caucasian men.

In the last decade, women have made great strides in banking, construction and dozens of other vocations formerly dominated by males.

Not so in research science, where only a few women have broken into the ranks. Some folks are wondering why.

Sea Grant researchers Celia Bonaventura and JoAnn Burkholder have some answers based on their own personal pursuits of science.

"The idea is that females are not encouraged to take risks in our society," says Bonaventura of the Duke University Marine Lab in Beaufort. "And only if a person is willing to take risks can they advance new things and be on the forefront of new ideas."

Both Bonaventura and Burkholder, a botanist at North Carolina State University, are respected scientists. As Sea Grant researchers, they have made important contributions to our knowledge of the marine ecosystem. Along the way, they've encountered barriers because they are female.

For Burkholder, the pressure started at home

"My mom tried to get me to be a secretary," she says. "But I knew what I wanted to do. When I was 15, I read an article about the nuisance algae that was threatening the Great Lakes. My interest was aroused, and I never looked back. I really wanted to make a difference."

Her father became her mentor. He taught her that being a woman should not stop her from doing what she wanted to do.

"My father is part Indian," she says. "He had a great reverence for the woods and for conservation. I remember him showing me bluebirds when I was four and helping me build a butterfly collection when I was five. Through him, I

developed that same reverence for the outdoors and that has guided me ever since."

But from her first job in science as a junior in college, the fulfillment of her career goals has not been simple.

Her first important research position was "extremely difficult," Burkholder says. "I was harassed by my male counterparts in a lab. I had to ignore it and go with the flow."

But sometimes she would lash out at men who exhibited what she calls a "knee-jerk reaction" to a woman in a research position.

"That was not good for me professionally," she says. "Now I'm trying to be more professional, gentler. I will let them know that it's not the kind of

But her father-in-law's influence alone didn't bring Bonaventura into the scientific limelight. Like Burkholder, she encountered those who believed only men could be scientists.

She says she "never did press the point of being female" to her male counterparts. Instead, she let her work speak for her.

"When people saw I wasn't going to be confrontive, there weren't any problems," she says. "I believed that the negative repercussions of being defensive was not a good way to proceed.

"I counted on my ability to make the science clear in every grant proposal I wrote," she says. "I was not offensive or defensive. I just presented my ideas and insights as science. It worked, and I succeeded."



Celia Bonaventura

thing I will accept, and then I'll go on with my work, which is the most important thing."

Bonaventura's major role model and mentor was her husband's father, an Italian physician who immigrated to America in the 1930s to flee the political repression of Benito Mussolini.

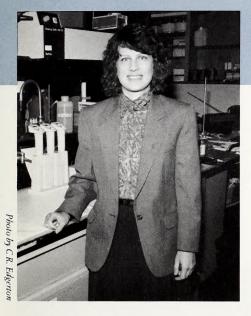
"He was a political rebel with a conviction that individuals do make a difference, whether they're male or female," Bonaventura says. "I was a junior in high school when I first met him, and he influenced me a great deal."

For Bonaventura and Burkholder, the risks have paid off. Both have successful careers and, at the same time, have been able to step away from the microscope to pursue satisfying personal lives.

But many females never get a chance to test scientific inclinations.

For most, the stifling of interest comes in junior high school. Recent studies have shown that male and female students show the same interest in math and science until they begin to take courses that require a certain amount of risk-taking. It is here that females fall by

rough C.R. Eagerion



JoAnn Burkholder

the wayside.

"It shows up early in math and science classes," Bonaventura says. "When risktaking is involved, almost instantly the guys take the lead. The girl feels hesitant about trying something risky."

The answer to the problem can be found in teachers who are willing to instruct girls that there is freedom in taking intellectual as well as social risks.

Teachers need to be raught not to squash kids, to show them that it's all right to explore and take chances and

make mistakes," Bonaventura says.

Though many teachers don't seem to be practicing that philosophy, there are what Burkholder calls "refreshing pockets" of educators who are encouraging young girls to consider science careers.

"It's going to take some time for society to change enough for the majority of women to feel comfortable with science as a career," she says, "But it's already changing for the better, and I'm encouraged by that."

Program Nurtures Future Minority Scientists By Carla B. Burge

It's tough being a science teacher. Burnout can happen fast when you're overloaded with classes and frustrated with students who don't seem to care.

And it's not easy being a student of science either, memorizing and regurgitating facts that seem irrelevant.

Add to that the pressure of being a minority who feels "locked out," and the whole thing can get discouraging.

Walter "Skip" Bollenbacher considered all these things when he began writing a proposal for a grant to promote minority advancement in science careers 21/2 years ago.

What resulted is the Program for Minority Advancement in Biomolecular Sciences, designed to "energize" science By Carla B. Burgess

education so that more minority students will choose careers in research or science education.

"If we have a human resource problem in the mainstream, it's that today's minority is tomorrow's majority population," says Bollenbacher, associate professor of biology at the University of North Carolina at Chapel Hill and the developer of the outreach program.

To take their proper places in the world of science, minorities need to have the self-esteem and the practical experience to succeed, he says. That's one of the goals of the outreach program, still in its infancy.

It is three-tiered in its approach, embracing faculty members and undergraduates at minority universities and science teachers at high schools with large minority enrollments.

It is organized around two courses. "Frontiers in Cell and Molecular Biology" provides information and promotes discussion about cutting edge research. The "Summer Research Challenge Course" is an intensive, hands-on laboratory course.



Nancy Mueller (at right) teaches the Frontiers course to undergraduates at North Carolina Central University in Durham.

Continued on next page

It's a cyclical program.

First, selected high school science teachers complete the "Frontiers" course through UNC's continuing education

program.

"We need to build their morale, to keep them excited about science, up-todate on it and thinking about it in a different way," says Bollenbacher. "They're scientists too. They just happen to be in science education and not research."

Through the course, the teachers become "revitalized" and carry that enthusiasm back into their classrooms.

together during a seven-week research lab, "where they'll do the very experiments they've been reading about," Bollenbacher says.

The Summer Research Challenge will begin with a hands-on study of biology at the coast and end in a research lab on the UNC campus.

"Students really don't get the thrill of discovery anymore—they don't understand the 'why' of learning it all," he says. In the lab, they will get to experience that excitement.

Terrance L. Johnson, director of the

lasting ones—between potential young minority scientists and their role models.

"For this to work, these teachers and students have got to become friends," he

A strong ally can help build self-esteem and confidence.

"The most important thing is that the students know they can accomplish in that field," he says. "This is especially critical with minorities."

Bollenbacher asks for empathy. Imagine you're the only black student in a research lab, he says. You know you're



Skip Bollenbacher

"They're excited about it; they get the students excited about it. And the students think, 'Hey, it isn't some boring thing with a bunch of beakers and nerdy people," says Bollenbacher.

Meanwhile, the program also considers the special needs of university professors.

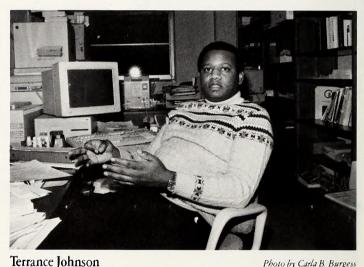
They experience burnout too.

To start with, selected faculty members from participating minority institutions are paired with a UNC-CH research scientist for a summer fellowship.

The program then "buys" those faculty members' time—in effect paying a substitute—so their course loads will be reduced enough to teach the Frontiers seminar at their home institutions.

"They're teaching a course for their undergraduates like the course we're giving the teachers at the high schools," Bollenbacher says.

The undergraduates who do well in the Frontiers course and the participating high school teachers will be students



Terrance Johnson

program, says this is where students get to truly feel the workings of science.

Photo by Carla B. Burgess

"It feels good to go in a lab, run an experiment and the dang thing works," he says.

The classroom portion of the program is unique too. It employs a "liberal arts" approach to science, Johnson says.

In a literature class, students read a novel, then go into the classroom and talk about it—what they understood, what they liked about it, what it means.

That's what students in the Frontiers class do-really discuss the bones of the research papers they read.

"What we're doing is creating an atmosphere of total gratification of studying science," Johnson says.

But for all the excitement and all the challenge it offers, some things about science are "still pretty impersonal," Bollenbacher says.

This is why the program is going to so much trouble to forge relationshipssmart. You know you're as competent as anyone else in the room. But you've been told you're not as good. And you're nervous.

"Can you think well when you're anxious?" Bollenbacher asks. "Of course not. You'll most likely perform below expectations. The process needs to consider that."

It's not about pacifying or making things seem easy. This is a competitive, challenging project that aims to bolster scientific skills and encourage participation with just an extra dose of TLC, he

'We're telling them, 'it may very well be a struggle, but you can do it and it's worthwhile," "Bollenbacher says.

The Program for Minority Advancement in Biomolecular Sciences is funded through a grant from the Howard Hughes Medical Institute, the Z Smith Reynolds Foundation and the Eisenhower Mathematics and Science Program.



Dear Readers:

We're making some changes in Coastwatch. This will be the last issue of Coastwatch, the newsletter. The next time it appears in your mailbox, Coastwatch will have been transformed into a 16-page magazine.

Why the change?

The newsletter was a limiting format.

Sometimes we had to curtail the information we provided because there wasn't enough space. And we were forced to keep our photographs and other graphics small so we could provide maximum information.

We simply had more to show and tell you than we could fit on eight pages.

But now we're going to expand.

We'll devote the first section of the magazine to a single topic. We will have three or four stories in the first eight or nine pages devoted to an issue shaping our coast.

Then we'll have regular departments.

One section will focus on recent Sea Grant research findings, another on the work of our Marine Advisory Service agents and specialists.

Youngsters will have a page of their own where we'll tell stories, introduce activities or relate interesting marine facts. For the older naturalist, we'll also have a section devoted to explaining the flora and fauna that make our coast unique.

We'll still have a section like our present Back Page devoted to news briefs, conference announcements and research updates. There'll be a bookstore department where we'll announce new and seasonal marine publications.

Finally, there'll be a page for you, the reader, to respond to our stories and ask questions.

The expanded format should provide you with more information, and the design will be pleasing to the eye. We'll publish every other month, and you can expect the first issue about June 1.

We're also going to have to implement another change—a subscription fee.

We have held off as long as possible, but the reality of our budget dictates that now we must charge a subscription fee of \$12. That fee was inevitable regardless of whether we publish a newsletter or magazine. The costs are virtually the same.

Sea Grant has received no federal budget increases in more than 10 years. Couple that with inflation, and you get less buying power. Add increased publishing costs and the shortfall in state funds, and you have a publishing budget that no longer allows us to give away more that 21,000 free newsletters.

We'll use the money raised from fees to supplement our federal budget for printing and production.

We hope you'll be willing to subscribe to Coastwatch because you believe it's a good value. In fact, we'll send you one free copy of the magazine so that you can decide for yourself.

We appreciate the support you have shown Coastwatch. We hope you'll find its new format just as enlightening and entertaining.

Thank you,

Kathy Hart

Editor

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

What's the best way to catch a wave?

If it's a "wave" of peeler crabs, why not try a crab pound?

That's what Sea Grant marine agent Bob Hines used last spring and summer to catch the pre-molt crustaceans.

Hines tested the pounds—a trap consisting of a lead net, heart and box—in Orchard Creek in Oriental during June, July and August.

In other parts of the eastern United States, pounds have been effective in catching peelers as they move in "runs" or "waves."

When blue crabs shed their hard outer shell, they remain soft for a brief period of

time. These soft crabs are a delicacy that can bring from \$12 to \$24 a dozen.

"The key to making enough money in shedding crabs is to catch enough peelers," says Hines. Some fishermen won't go to the trouble of culling the potential soft crabs. As a result, millions of peelers are inadvertently sold on the hard crab market.

"The idea with the crab pounds is to find some way to get that supply of peelers so that shedders can justify expanding their operation to derive more profit," says Hines.

To learn more about building and using crab pounds, write Sea Grant for a free copy of "Building and Using Crab Pounds to Catch Peelers." The publication number is UNC-SG-BP-91-01. The address is Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695.

If the town of Nags Head has its way, no one there will be served on Styrofoam or any other polystyrene products.

The town board is asking the legislature for the right to ban the use of polystyrene in prepared meal packaging.

A ban would reduce the amount of plastic litter along the roads and beaches,

says town manager Webb Fuller.

But that's not all. Production of some polystyrene has been linked with the depletion of the earth's ozone layer.

Fuller says the town wants to make a statement about protecting the environment.

"We've had some discussions with local restaurant owners, and they're basically in favor of it," he says. "I think they're willing to adjust."

Fuller said the ban would apply only to prepared meals packaging—such as from restaurants or grocery store delis.

If passed, the legislation would apply to other willing local governments in Dare County, Fuller said. Nags Head may set a precedent for other Tar Heel communities.

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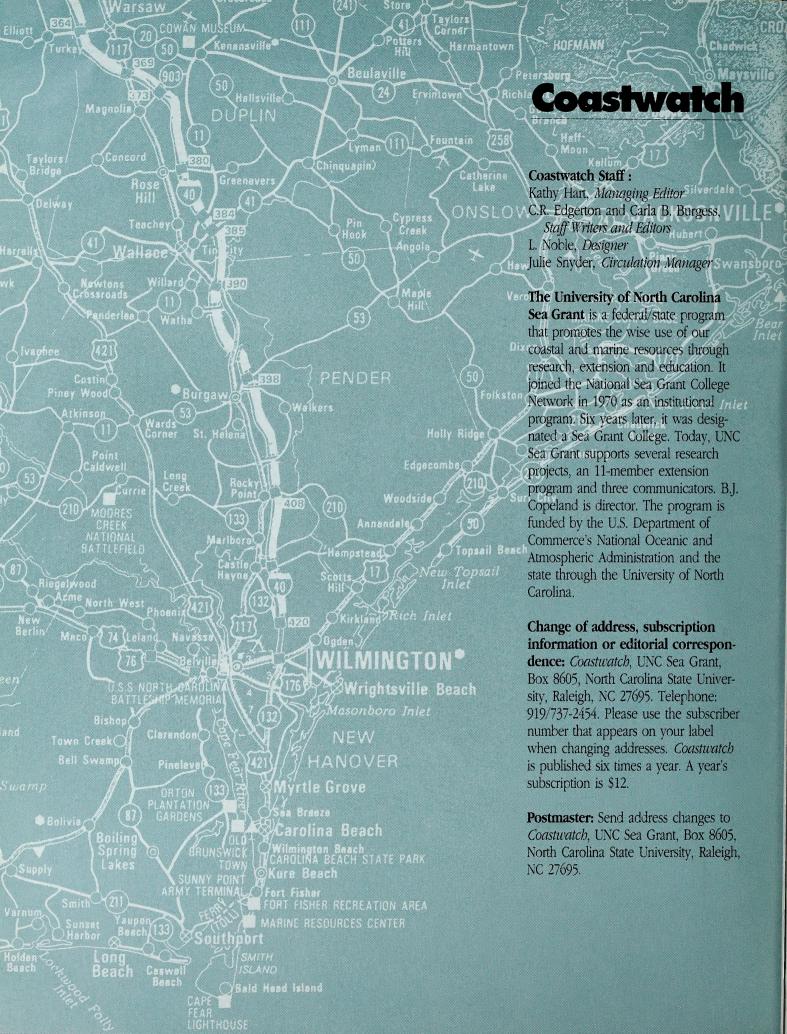
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From The Top

Dear Readers:

Welcome to the new *Coastwatch*. We hope you'll enjoy reading our expanded magazine as much as we enjoyed researching and writing it.

We chose as our initial topic: New Hanover County and the lower Cape Fear River.

In my story, I'll introduce you to New Hanover County's largest city — Wilmington. I interviewed city leaders and economists to get an idea how the completion of Interstate 40 had impacted the port city and what role the four-lane would play in Wilmington's future.

C.R. Edgerton walked the boardwalk at Carolina Beach and sifted the renourished sands of Wrightsville to contrast New Hanover's blue-collar and white-collar beaches. Edgerton also toured uninhabited Masonboro Island, one of the state's estuarine sanctuaries. You'll relive the visit.

Carla Burgess poured over books, strolled through a graveyard and took a chair at Pollock's Shoeshine to get an insight into the region's history. She'll tell you what she learned in three stories about the port city's past.

Then we'll introduce you to our new sections: Field Notes, Marine Advice, Sound to Sea, Young Mariners, Back Talk, Aft Deck and The Bookstore. Some of these sections also have a New Hanover angle.

We hope you like our first effort. This copy is free. But if you want to continue receiving our magazine, you must pay an annual subscription fee of \$12. You will be receiving subscription information in the mail in a few days. Just return your form and your check, and we'll make sure you continue to receive our magazine.

Hope to see you next month, Kathy Hart

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By Kathy Hart

A decade ago Wilmington may have been the best kept secret in North Carolina.

The sleepy little port city that hugged the left bank of the Cape Fear River oozed southern charm, hospitality and history.

It was a city of church steeples, brick-paved streets, antebellum homes and stalwart southern families who had laid down their foundations along with that of the city.

Adorned in azaleas, magnolias and live oaks, Wilmington anchored New Hanover County and southeastern North Carolina. It perched alongside a river that brought tall ships, steamers and cargo vessels to call.

It was graced with cool summer breezes and warm winter winds. It boasted a university by the sea and 36 miles of nearby public beaches.

It had all the elements that attracted thousands to Charleston and Sayannah.

All but one.

Wilmington lacked connections.

There was no main artery feeding the city a steady diet of commerce, tourists and would-be residents. Wilmington was the only major city on the Eastern Seaboard not linked to the nation's interstate highway system.

And halfway through this century, Wilmington lost its Atlantic Coast Line Railroad to a merger. With the railroad went much of New Hanover County's economic stability.

The city that had turned the 20th century as North Carolina's largest had stagnated while Charlotte, Greensboro and Raleigh-Durham moved ahead to become retail, research, banking and industrial meccas.

Many blamed that stagnation on the lack of four-lane highways feeding into the port city.

But in the 1980s, Wilmington began to grow despite its lack of connections.

As the largest city in southeastern

North Carolina, it drew people from the surrounding counties of Pender, Columbus and Brunswick in North Carolina and Horry County in South Carolina, says Joe Augustine, executive vice president of the Greater Wilmington Chamber of Commerce.

"Wilmington has become a regional shopping center," Augustine says. "People commute up to 75 miles to come to Wilmington to shop for bigticket items such as cars, boats and furniture; for medical and educational services; and for recreation."

And the beachfront building boom of the 1970s and 1980s sent folks scurrying to the New Hanover shores of Wrightsville, Carolina and Kure beaches to buy seaside retreats.

"Weekend warriors," as they were called by native Wilmingtonians, flooded the area from Friday until Sunday as they traveled from points west to their second homes.

But neither its weekend warriors nor its reputation as a regional shopping

A Brighter Future at the End of the Road

hub were enough to put Wilmington in the same league as Charlotte, the Triad or the Triangle.

It still needed a four-lane highway to tie the port city to the rest of state.

Finally, in 1984 the U.S. Department of Transportation approved plans to extend Interstate 40 from Johnston County to Wilmington, some say with assistance from North Carolinian and then-Secretary of Transportation Elizabeth Dole.

Wilmington waited.

Some businesses, such as hotels and retail shops, were so sure I-40 was the golden egg Wilmington needed that they built ahead of the highway's completion.

College Road, the planned terminus for I-40, developed into a shopper's paradise as several sprawling retail centers were built side by side. Hotel chains and fast food restaurants jockeyed for position along the main thoroughfares of College Road, Market Street and Oleander Drive.

To entice high-salaried professionals and rich retirees who might move to the river city, the late J.P. Goforth began development of a 2,200-acre exclusive residential haven.

Named Landfall, the development sports two golf courses and one tennis complex, all designed by big-name pros. Lots, most less than an acre, average more than \$200,000; homes built on them cost \$400,000 or more.

As the outskirts of Wilmington developed, downtown spruced up too. Using federal, state and local money, the city of Wilmington built a riverfront park about one block from the heart of downtown.

Private investors renovated Chandler's Wharf and The Cotton Exchange, Low-interest federal loans were offered to other downtown businesses for facade improvements. And the city laid brick streets, hung

special lights, planted trees and put a few police on horseback all for the benefit of tourists.

Wilmington was ready.

On June 30, 1990, I-40 was opened, completing the connection between Raleigh and Wilmington. The four-lane, limited-entry highway opened the artery that connected Wilmington to the rest of North Carolina and the nation, and it began slowly to pump economic adrenaline into the city by the sea.

If Wilmington's business leaders expected an overnight boom town, it was not to be.

"I-40 didn't open at the most auspicious of times," says David Hartgen, a professor of transportation at the University of North Carolina at Charlotte. Hartgen has been authorized by the state to complete an economic impact study of I-40's final link.

The Persian Gulf deployment began a month later and the economy was sluggish, Hartgen says. As a result, people weren't traveling, vacationing or buying new homes last year, and I-40 failed to be the immediate economic

shot in the arm everybody anticipated.

But that doesn't mean I-40 will not pay off.

"I-40 should have a steady, but significant effect on Wilmington's growth," Hartgen says. "The opening was a watershed event similar to the coming of the railroad. It should be the most significant event on the local economy for 50 years either side."

"Now people are going to realize there are two Wilmingtons on the East Coast," says economist William Hall, referring to Wilmington, Del.

Hall and a colleague at the University of North Carolina at Wilmington, Claude Ferrel, have been keeping a finger on the economic pulse of Wilmington for the past ten years.

They project that the area's economy will double in the next ten years. Augustine says the Wilmington Chamber of Commerce forsees similar growth.

"We expect the next big explosion of growth in North Carolina to come in Wilmington," Augustine says.

And it's already starting.

A new regional international airport located on the north side of the city has just opened. Its completion means Wilmington has all the right connections — air, sea and land.

The airport has U.S. Customs and U.S. Department of Agriculture inspection and international landing rights, which is prompting a growing stream of foreign traffic.

"Our international arrivals have increased 30 percent over last year," says Robert Kemp, airport director.

The first big international charter began in May, flying between Wilmington and Jamaica. The New Hanover airport lies directly beneath one of the main air routes to the Caribbean, which may assure more tropical flights in the future.

The airport also does a brisk

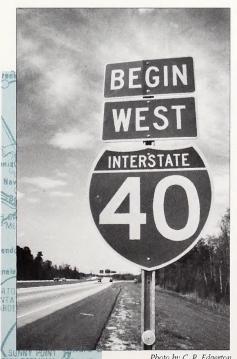


Photo by C. R. Edgerton

business in cargo, corporate aviation and military traffic. And three commercial carriers — USAir, American and Delta — serve the public.

As for the future, the airport has big ideas. Plans call for an adjacent commercial and industrial park that will include a hotel and convention center.

On the south end of town, another transportation link, the state port, is beefing up its image and its facilities. After several years of running in the red, the State Port of Wilmington is showing a profit.

In competition with neighboring ports in Virginia, South Carolina and Georgia, the Wilmington port has lagged because it was not linked to the nation's interstate system, Hall says.

But the completion of I-40, the introduction of intermediate transportation terminals in Charlotte and Greensboro, and a more aggressive marketing campaign spell a brighter future for the Wilmington port.

Wood pulp and tobacco are the most prevalent cargoes leaving Wilmington; steel is the top imported item. But cargoes run the gamut from soybean oil to mobile homes.

Almost 33,000 tons of military equipment, shipped from Fort Bragg and Camp Lejeune to the Persian Gulf, passed through the North Carolina ports. This meant weeks of round-the-clock, seven-day-a-week operations in

On June 30, 1990, I-40 was opened, completing the connection between Raleigh and Wilmington. The four-lane, limited-entry highway opened the artery that connected Wilmington to the rest of North Carolina and the nation, and it began slowly to pump economic adrenaline into the city by the sea.

Wilmington, says Karen Fox, the ports' public affairs manager.

Although the military movement gave the ports a short-term boost, the ports authority is looking to North Carolina businesses to give it long-term stability.

North Carolina is among the top 10 states in the nation in manufactured goods and the top in the Southeast. Yet only 20 to 30 percent of ocean-bound cargo leaving Tar Heel companies passes through our state ports, Fox says.

The ports are striving to capture a larger percentage of Tar Heel business. And if successful, the Port of Wilmington could have a greater impact on the city's future.

But for now, a larger player in Wilmington's economy is "UNC By The Sea."

The seaside university draws 7,000 students and is growing at a rate of 6 percent a year, Hall says.

Hall calculates that the university, renowned for its marine science curriculum, accounts for eight cents of every dollar spent in an area that encompasses New Hanover, Pender, Columbus and Brunswick counties.

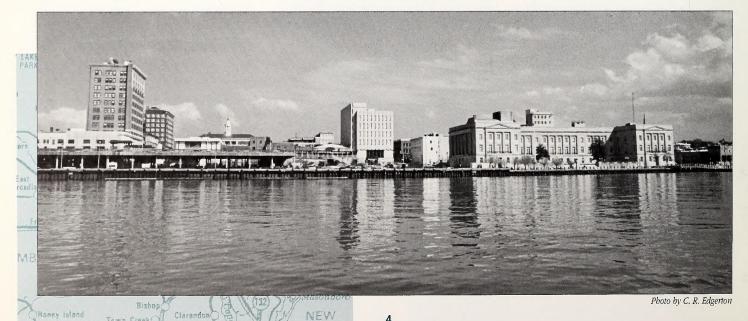
"That's two and a half times the impact the port has on the same region," Hall says.

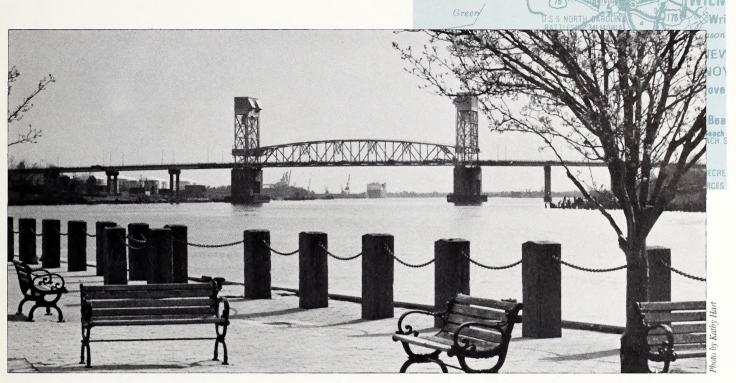
In recent years, the university elevated its academics to the same level as East Carolina, Western Carolina and Appalachian State universities. "UNC By The Sea" now offers master's degrees, and it's working with North Carolina State University to offer a Ph.D. in marine science.

Once seen as a regional university, UNC-Wilmington drew its students from southeastern North Carolina. Now its academic reputation attracts students from across the state and the nation, and the completion of I-40 makes access to the campus even easier.

University buildings and other major Wilmington landmarks have been a part of another major player in Wilmington's economy — the movie industry.

Filmmaker Dino DeLaurentis opened shop in the Cape Fear city in the early 1980s. At the height of production, his DEG Studios were working on four films simultaneously and pumping \$1 million a week into the local economy, Augustine says.





MANA

But DeLaurentis hit hard times and left town more than three years ago. Many thought that would end Wilmington's role as a movie mecca.

Not so. Carolco Pictures bought DEG Studios and continued to reel off box office hits, though not at the same rate as DeLaurentis. Carolco uses the studios for its own features and commercials, and it rents to other filmmakers.

Recent Wilmington films include "Sleeping with the Enemy" and "Teenage Mutant Ninja Turtles II."

But Hall questions the movie industry's staying power.

"They came here because it's an inexpensive place to make movies," he says. "But if costs rise as Wilmington grows bigger, then they may start to look elsewhere."

But others say the opening of I-40 offers the studio added incentive to stay. It not only makes Wilmington more accessible to moviemakers, but it makes areas outside the port city reachable too.

As for industrial growth, New Hanover County is at its limit. "We're running out of space for any large-scale industrial growth," Hall says. "There are a few sites in the northwest, and that's it." Economists are predicting that any new industries brought to the area by I-40 will locate in adjacent counties, where land is more available and unemployment rates are higher.

Even there, industrial growth on the Cape Fear River may be limited by state water quality standards.

One economic factor nobody wants to limit is tourism. Although Wilmington doesn't want to be known as a tourist town, visitors still make the largest contribution to the New Hanover economy.

Most are drawn to the beaches at Wrightsville, Kure and Carolina, but others come to play — golf, tennis, sailing and boating. According to Augustine, 20 golf courses are scattered across New Hanover County

"The area is changing its image from a port city and beach community to a recreational community," Hartgen says. "The local economy will not be driven by residents but by those coming from outside the area to spend their disposable income."

But for all the positives I-40 brings, there's also trouble right here in river city.

One problem begins where I-40 ends: College Road. The interstate is dumping 12,000 cars a day into an area

teeming with shopping centers, fast food restaurants and college students.

"That area is being hit with a slug of traffic," Hartgen says. "It was predictable but not well-planned."

Now Wilmington and New Hanover County officials are scrambling to work out some solutions. They are discussing the possibility of an outer loop to route beach traffic around the city.

Others are concerned about the capability of Wilmington's water and sewer systems to handle additional residents and businesses. And still others worry about the effects of the development on the nearby river and estuarine ecosystems.

Many long-time residents, accustomed to Wilmington's sleepier days, complain that the quality of life in the port city is declining. They rue the day when I-40 was opened.

But if these folks are upset, economists and planners say they "ain't seen nothin' vet."

Hartgen predicts that the summer of 1991 will be prosperous because the Gulf War has ended and the economy is rebounding.

"You can't go back," Hartgen says.
"The ribbon has been cut. Now all you can do is plan for the future."

Sister Beaches Have Little in Common

By C.R. Edgerton



Photo by C. R. Edgerton

A subtropical wind coming off the ocean grabs sand and hurls it against elaborate beach cottages and expensive cars.

Fashionably dressed beachgoers search for shells among rusty pipes called into service every winter to resupply the sand-starved beach.

Sunbathers recline on lounge chairs and blankets, seemingly unaware of surfers just beyond the breakers and fishermen on the pier above.

A tern soars behind the island's now non-existent dune line. He finds little landing space, for the last lot on Wrightsville Beach has been sold.

Farther south, at Carolina Beach, a young couple —honeymooners perhaps — drift into the Seven Seas deli and grill. He orders a sub, she a hot dog. At the bar, a man in tattered clothes finishes a sandwich, gulps beer and grabs a hot dog to go.

"See you tomorrow," he tells the woman behind the counter.

About a hundred feet beyond the deli, a woman squints as she walks from the Carolina Beach bingo parlor into the full light of the sun. Her hair is curled and pinned tightly to her head. A cigarette dangles from her bottom lip. She checks her huge leather pocketbook and turns south down the boardwalk.

At the Kure Beach fishing pier, just south of Carolina Beach, life goes on as it has for decades: folks from all over the southeast sling their lines into the swelling surf, hoping for the big one that always eludes them.

When the fishing's bad, some wander off the pier and into Bud and Joe's Tavern on the north side of the parking lot, or the small restaurants on the southside.

Sandwiched between the popular beach resorts, Masonboro Island stands totally undeveloped, a monument to nature, a stretch of unspoiled coastline amid overdeveloped shores.

These, with the exclusive Figure Eight Island to the north and Fort Fisher to the south, are the beaches of New

Hanover County. They exhibit a curious contrast of the wealthy and the not-sorich; the white-collar condo and the blue-collar boardwalk; the tall-masted yacht and the fiberglass skiff.

Unlike most North Carolina coastal communities, change is slow here. But it hasn't always been this way.

A century and a half ago, New Hanover's beaches were as barren and uninhabited as Masonboro Island is today. They were sought as places of refuge and recreation, yet their inaccessibility left them undeveloped and pristine.

That was before the Carolina Yacht Club made its appearance on Wrights-ville Beach. In the mid-1850s, several men, tired of rowing their small boats to the island only to have no bathing facilities, joined forces to build the bath house. It was one of the first of its kind in the nation.

A railroad was built to the island between Wrightsville and the mainland in 1883 and local folks began to catch a vision of the playground the beach might become. Finally, the waterway between Harbor Island and Wrightsville was breached by a walkway. The development of the beach had begun in earnest.

The Wilmington Sea Coast Railway Company played a major role in the development of Wrightsville as a rendezvous for the wealthy. The company offered moonlight excursions to the island.

The beach's popularity grew and by 1897 about 50 beach cottages and several hotels had sprung up where before there had been only sand dunes and sea oats.

The greatest and perhaps most famous of the structures was the Lumina, a hotel ringed by hundreds of lights. The resulting night scene became not only a symbol of prosperity on the beach but a navigational aid for passing ships.

The rich and famous cavorted on Wrightsville Beach and gave to this narrow strand its reputation as a place



of affluence. In the 1930s, the island's electric cable car system was replaced by a state-maintained highway and more common folks invaded the Wrightsville domain. Yet, through the years, the wealthy have found a place of refuge on the island.

The story of Carolina Beach isn't glamorous. Carolina was developed primarily by Wilmingtonians who desired a place at the beach away from the exclusive lifestyle at Wrightsville.

For decades, the best route to Carolina Beach was via one of Captain John Harper's famous Cape Fear River taxi boats. By the 1920s, state-maintained roads were built and the community blossomed as a resort.

For the average family with limited vacation funds, Carolina Beach's primary attraction has been its boardwalk, a long train of restaurants, amusement centers and gift shops.

Today, Wrightsville and Carolina beaches still offer their own styles of coastal life.

"Wrightsville is more of a family vacation type beach," says Jane Peterson, executive director of the Cape Fear Coast Convention and Visitors Bureau.

Though parking is limited on this island of 5,000 permanent residents, several access points open the door to the public beaches for day trippers and college students from the University of North Carolina at Wilmington.

"And Carolina is a fun beach with

fishing and lots of things to do," Peterson says. "It has a great feeling of nostalgia."

The differences in the two beaches are emphasized in her office's promotional material, Peterson says.

"But both of the beaches realize how unique they are on the whole East Coast," she says. "Having seen beaches from Maine to Florida, I can say that ours are great."

Unique enough, she says, to foster lots of economic imput from local governments who have become accustomed to a steady stream of tourist dollars.

At Wrightsville, a \$2 million, fouryear beach renourishment program guarantees that the 25 to 30 feet of shoreline eaten annually by Mother Nature will be replaced. This gives visitors and permanent residents all the sand they want and assures the town's fathers a juicy tax base.

And, at Carolina, old and unsightly beach cottages have been renovated or torn down and replaced by more modern structures. Beach renourishment and a recently completed facelift on the town's once sagging boardwalk attract new and return vacationers.

"There are some really great things happening on our beaches right now," Peterson says. "There are chambers of commerce at both Wrightsville and Carolina Beach. The businesses are organizing to promote things there."

Their efforts have created what Peterson calls "a real spruce-up and a tourism feeling.

"We've even got someone who's sponsoring a water taxi out to Masonboro Island," she says.

Recent completion of Interstate 40 into Wilmington can't hurt the flow of dollars from the pockets of beachgoing tourists either.

But, Peterson says, a new superhighway doesn't automatically open the floodgates of tourism. So far, I-40 hasn't been the economic pie-in-the-sky Wilmingtonians have longed for.

"I don't think I-40 has made a big difference in the amount of traffic itself coming to the beaches," Peterson says. "But it has made it more convenient for those who do come."

She sees the new highway more as a tool. "You see, it helps us market what we do have," she says. "Now it's up to us to get out there and market it."



Photo by C. R. Edgerton



Masonboro Island: An Unspoiled Gem

By C.R. Edgerton

The wind whips up small whitecaps in the tidal waters of Masonboro Sound.

The small boat pops the water like a fishing lure.

From his seat on the bow, John Taggert points to a high dune near the north end of Masonboro Island.

"It's the highest point on the island," he says. "You'll be able to see most of the island from there."

The pilot cuts the engine and the boat drifts to the small beach on the sound side. The anchor holds fast in the smooth sand, and we step ashore – alone on a nine-mile stretch of uninhabited, undeveloped barrier island.

At the top of the small dune, we are amazed at what we see: no beach cottages, no streets, no high-rise condominiums, except those across the inlet on neighboring Wrightsville Beach. To the east, the island is black skimmers,

least terms and dune plants; to the west, it is extensive salt marsh.

"This is great," says Taggert, who oversees the island as part of the National Estuarine Research Reserve program. "I love coming out here."

And why not? Unspoiled Masonboro Island is a dream-come-true for naturalists and others who enjoy coming to the beach without worrying about walking where they aren't wanted.

The island is one of four Tar Heel estuarine reserves under Taggert's care (the others are Zeke's Island south of Fort Fisher, a small section of Currituck Banks near Corolla, and the Rachel Carson Reserve on Bogue Banks near Beaufort).

In winter, the island is seldom touched by human feet.

In warm weather, dozens of small boats line up on the island's soundside

beaches. Swimmers, sunbathers and beachcombers cut their ties with the overdeveloped mainland and join gulls and terns, skinks and spiders on unspoiled beaches and wind-kissed dunes.

To many folks in New Hanover County, Masonboro Island is a rare gem in a costume jewelry store.

And recent designation as part of the estuarine reserve program guarantees an ecologically bright future.

Taggert explains that Masonboro Island's weaknesses – in terms of its developability – are its major strengths. For example, the island's uplands, those areas that are never under tidal waters, are too narrow for buildings. The rest of the island's 5,000 acres is salt marsh, incapable of supporting development.

"The people around here love this place," Taggert says. "Even the landowners want it preserved as a natural area."

They do indeed. Hundreds of acres have been ceded to the reserve by

conservation-minded landowners.

Others aren't quibbling with the reserve designation, happily signing over their property to the federal government for a fair price.

"We still have some landowners who are holding out and some we haven't contacted about purchasing their land," Taggert says. "But I believe all of them will come around."

Taggert steps down the beach side of the dune. His feet sink into the warm sand, sliding past the hungry thorns of a prickly pear. He points to a flattened hollow between the larger dune line and a smaller dune toward the beach.

"Look here," he says. "Signs of campers. The burned sticks, shells piled up. Someone gathered them and just left them there."

Camping is only one of the traditional uses of Masonboro Island.

Though it's accessible only by boat, mainlanders visit the island frequently in warmer months, using its resources for typical beach activities.

They leave hundreds of footprints in the island's ecologically-sensitive sands. But that doesn't worry Taggert.

"People have been using the island for many decades, even before Carolina Inlet was cut to the south and while it was just an extension of Carolina Beach," he says. "And, while litter sometimes becomes a problem in the summer, we don't think the island is being abused."



"I love coming out to Masonboro, and it's always hard for me to leave. It's one of my favorite places to be."
---John Taggert

He says he'd like to see someone survey the island's users. "That would give us some idea of whether or not we should regulate some uses," he says. "Still, you can just look around and see that things are pretty much in their natural state."

Perhaps that's why people aren't the only users of the island. Because of its extensive undisturbed beach, loggerhead turtles depend on the island as a prime nesting site. Turtle eggs laid at Wrightsville and Carolina are sometimes transferred from those busier beaches to the safer sands of Masonboro.

"The people who use the island are proud of the turtle sites and protect them well," Taggert says.

Other significant fauna that have found safe refuge on Masonboro include the threatened piping plover and the endangered peregrine falcon. The falcon uses the island as a stopover on its annual migratory routes.

"These are the things that make Masonboro Island valuable not only to the average person, but to researchers and scientists as well," Taggert says.

He gives much credit for the island's preservation to a wide-ranging grassroots movement and "solid local legislative support," including efforts by the members of the Society for Masonboro Island.

"These people have been instrumental," he says. "You can tell they really love their island. It makes me feel good about the future of this place."

Back at the sound, we step lightly into the small aluminum skiff. A rope is pulled and the motor churns. As the boat cuts the water toward the ramp at Harbor Island, we watch Masonboro Island hide behind the high-rise condos on Wrightsville and the tall-masted pleasure yachts lining Banks Channel.

"This is the part I always hate,"
Taggert says, catching a last glimpse of
the island reserve. "I love coming out
to Masonboro, and it's always hard for
me to leave. It's one of my favorite
places to be."



Photo by C. R. Edgerton

Tracing Cape Fear Legend and Lore

By Carla B. Burgess

Nearly two centuries of Cape Fear history sleep beneath the canopy of oaks, dogwood and Spanish moss in Wilmington's Oakdale Cemetery. The tiny lamb that shelters 6-year-old "Annie," the mausoleums as big as houses and the mass grave of Confederate soldiers tell the story of this river town.

Just west, the river and its main tributary from the northeast converge and begin a 30-mile southern journey to the Atlantic Ocean.

In the days when rivers were highways, the 200-mile Cape Fear connected New Hanover to a family of inland counties and their commercial offspring. In 1853, it was said to be the outlet for the products of more than 28 North Carolina counties. Through its mouth at the Atlantic breathed vital trade between the West Indies, Spain and other ports of call.

As the wind whips around granite crosses and white stone angels in Oakdale's 160 acres, one can almost hear voices whispering the Cape Fear legend. Wilmington owes its existence to the river, whose waters carved this high, dry outpost for early settlers and their ancestors.

The river put New Hanover County on the map and in the history books.

In Oakdale lies Rose Greenhow, a rebellious woman and Confederate spy who drowned while attempting to run

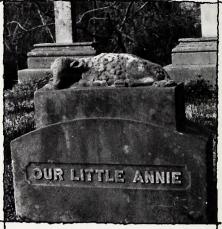
the federal blockade at Fort Fisher, 18 miles south of Wilmington. When President Lincoln ordered his navy to block all Southern ports, the inlet there provided vital access for blockade runners bringing supplies through the town, the last major Southern port to fall.

Through this breach, swift, shallow-draft vessels with such names as *Beauregard*, *Banshee*, *Spunkie* and *Night Hawk* fueled General Lee's Richmond army and the ire of federal officials.

One night in 1863, another woman who desperately wanted to visit her son in England boarded the blockade runner *Advance* leaving Wilmington for Nassau. Anna Matilda McNeill Whistler was born in Wilmington, where she lived much of her childhood. A widow, she had just visited her other son, a Confederate army surgeon in Richmond.

Mrs. Whistler's journey was safe. Her son "Jamie," an artist, took her in to his London home and later immortalized her in a painting he called "Arrangement in Gray and Black." Most of us know it as "Whistler's Mother."

War and commercial traffic benefited from New Inlet, which was cut by a hurricane in 1761. But although this second mouth made Wilmington more accessible, it let in sand and silt with every change of the tide. The river's channel was barely 9



oto by Carla B.

feet deep under the most favorable conditions.

After the war, talk of closing the inlet resumed.

Henry Bacon, whose grave marker can also be seen in Oakdale, supervised the U.S. Army Corps of Engineers' late-19th-century construction of the "Rocks," a rubble stone dam across New Inlet and nearby swashes. More than 181,000 cubic yards of stone were used in the New Inlet dam, equivalent to a wall 8 feet high, 4 feet thick and 100 miles long.

To date, Bacon's enterprise is considered the most outstanding Corps project in the South Atlantic. Bacon's son, Henry, buried nearby, is also credited with a memorable structure. He was the architect of the Lincoln Memorial in Washington, D.C.

Other graves reveal less celebrated names, but famous stories. The tugboat captain who lost his life fighting a fire at Front and Dock streets, buried with his dog who tried to rescue him. A young girl who died at sea, preserved for burial in a cask of rum and whiskey, seated in a chair.

A Confederate soldier cast in bronze guards the grassy repose of his comrades near Oakdale's front gates. Outside, the ghost of Cape Fear past dances about olden streets and the wrecks of wooden ships beyond the river's bank.

Engineer Henry Bacon Sr. (in white beard and long coat) supervises the construction of "The Rocks" below Fort Fisher.



Reproduced Courtesy of the New Hanover County Museum of the Lower Cape Fear

A County's Claim to Fame

By Carla B. Burgess

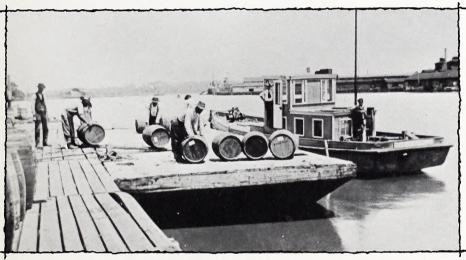
The saga of the lower Cape Fear region is a litany of firsts, bests and biggests.

North Carolina's first lighthouse was constructed at Bald Head Island, the southernmost tip of the cape. Lighted in 1795, it helped ships navigate the treacherous Frying Pan

Verrazano's report of friendly Indians, fragrant bay laurel, and vibrant fields and forests didn't tempt the king, preoccupied by troubles at home, to settle the area.

A settlement attempted near present-day Wilmington by New Englanders in 1662 was abandoned in a matter of months.

In 1664, a group from Barbados established Clarendon County along the west bank of the river. The settlement reportedly numbered 800 people and extended 60 miles along the Cape Fear, which they called Clarendon. Its capital, Charlestown, was the first English town in Carolina.



Workers load naval stores on a wharf at Eagles Island.

Shoals that extend almost 20 miles outward from the river's turbulent mouth.

It was here that a group of 16th-century Spanish explorers wrecked as they tried to enter the river. The vessel they built to replace their ship is said to have been the first built by Europeans in America.

If Lucas Vasquez de Ayllon and his fellow Spaniards had remained, the Cape Fear region would have been home to the first white settlement in America.

Ayllon's predecessor is the first known visitor to the Cape Fear region. Verrazano, an Italian in service to the king of France, explored the area in 1524 on a voyage to find a faster route to Asia.

Lack of British support and hostilities from Indians that the settlers tried to enslave contributed to the colony's demise by 1667.

The first permanent colony on the Cape Fear came much later with the 1726 settlement of Brunswick Town. A rival town was settled opposite on the east bank in 1733. Called New Carthage, New Liverpool, then New Town or Newton, the settlement was finally incorporated in 1740 under the name Wilmington.

In addition to the river, early settlers recognized the value of the vast pine forests towering over them. The product of these trees – tar, pitch, turpentine and rosin – eventually earned Wilmington the distinction as the world's leading exporter of naval stores.

The region also lays claim to the first student of the University of North Carolina. Hinton James distinguished himself further by reportedly walking the 150 miles from his New Hanover County home to Chapel Hill to enroll in 1795. For two weeks, he was the entire student body.

James, who earned his degree in engineering, was credited later with some initial work to deepen the channel of the river in the 1820s. The project, which included dredging and jetties, was the first effort made to keep the Cape Fear navigable.

Here are some other exclusive claims made by the port city.

- The Prince of Parthia, the first play written and produced in America, was penned by the author the same year he arrived in Wilmington, 1759. Thomas Godfrey died four years before its 1767 premiere in Philadelphia, and is buried in St. James churchyard on Market Street.
- The Temple of Israel, the first synagogue in North Carolina, stands at the southeast corner of 4th and Market streets. When it was dedicated in 1876, nearly 70 percent of the state's Jewish population lived in Wilmington.

For more information about the lower Cape Fear region, check these references:

Chronicles of the Cape Fear River by James Sprunt

The Cape Fear by Malcolm Ross Stories Old and New of the Cape Fear Region by Louis T. Moore

To Great and Useful Purpose: A History of the Wilmington District, U.S. Army Corps of Engineers by Ronald B. Hartzer

Tales and Traditions of the Lower Cape Fear by James Sprunt

Land of the Golden River by Lewis Philip Hall

New Hanover County: A Brief History by Lawrence Lee

Cape Fear Adventure: An Illustrated History of Wilmington by Diane Cobb Cashman By Carla B. Burgess

The sign in back of the narrow room is a little dusty. But its plastic letters plainly state the menu. Shoeshine, \$2. Pig feet, 75 cents. Alka Seltzer, 30 cents.

If Haywood Graham is around, you might also get an earful.

From the vantage point of Floyd Pollock's Shoeshine Parlor and lifelong residency in this port city, Floyd and Haywood can give you a personal history of Wilmington. Loudly. And they don't always agree.

Ask them where television newsman David Brinkley used to live in Wilmington, and you might see their arms pointing in more directions than signs at an intersection. Consensus is not an issue at Pollock's Shoeshine.

On an early spring day, Pollock and Graham talk about old times over a game of cards. A tiny gas heater takes the chill off the small room and heats a coffee can full of water.

Pollock was born in Wilmington in 1918 and is retired from Almont Shipping Company on the waterfront. He worked in the warehouse there "all my life." His shoeshine parlor at 708 N. 4th St. keeps him busy and out of the house, he says.

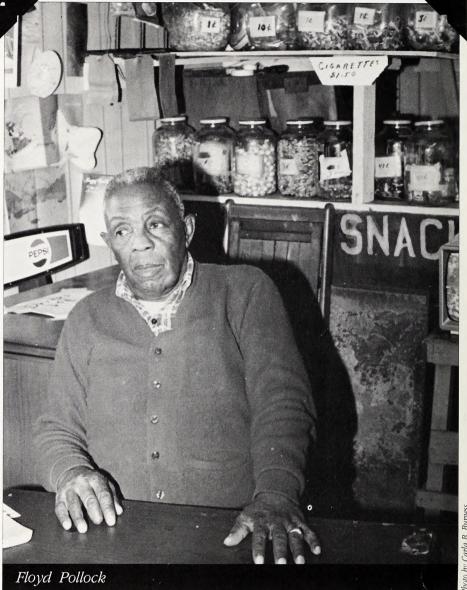
Graham was a longshoreman many years on the lower Cape Fear River and loaded and unloaded everything from paper and tobacco to automobiles and fish meal.

"We had a gang system here in this port," Graham says, explaining how they worked the waterfront.

Graham, a "header" or foreman, would choose his crew from the group of longshoremen who "badged in" at the union hall each morning. Then he was ready to start to work a shipment.

"I've got two crane operators, two bulldozer operators, and I got a signal man and about 20 more men in the gang," he says, describing how a gang of workers would empty a ship loaded

Swapping Stories



with nitrate of soda — fertilizer in bulk.

Graham says a crane would lower a bulldozer onto the ship to move the fertilizer so it could be placed in a bucket and raised to the deck. The work could be dangerous, and long-shoremen were sometimes killed.

"Sometimes it would take two or three days to get to the bottom of a ship," he says. The "hatch" or signal man would be the liason for communication between the crane operator and bulldozer drivers, he says.

The crew washed down the decks afterward, but tougher environmental

regulations have banned that practice. "The EPA don't play," Graham says, studying his hand of cards. "Containerization" has become the name of the game, he says. "They don't want anything but clean cargo in this port now."

A few blocks southwest of Pollock's business — in a spacious building at 201 Chestnut St. — you can get a different historical perspective.

Almost any weekday morning you'll find Robert Fales on the second floor of the New Hanover County Public Library. Since his retirement from 53 years as a Wilmington physician, he to by Carla B. B

of Old Wilmington

keeps regular office hours in the local history room.

If you arrive before Fales does, the librarian can point out exactly where he'll sit.

He arrives dressed in a suit and sweater vest. Once seated, he talks for hours about the town.

The native Wilmingtonian has studied the history of this region for 25 years. He started out collecting information about doctors who practiced here during the past century.

salvaged the material to surface their streets.

"When I was a child, everything was downtown, but scattered all around the neighborhoods. Chinese laundries, we had lots and lots of them," says Fales.

Back at the shoeshine parlor, a thin, black man in sunglasses leans against the wall, listening. He is exasperated because Floyd and Haywood aren't telling stories as vividly as they usually do.

the line, Haywood says. He would wait with other children for the chance to pull the cord that would reverse the arm over the car.

"It didn't matter how long you had been waiting, you just had to get up there first," says Graham. "Then the driver would throw you a nickel."

In the 20s, a nickel would buy you a trip across the river's toll bridge on foot or bicycle. It cost 35 cents for the Pollock family's old Dodge to pass.

Times were tough then. Pollock



"As the work went along, I found I could not separate it from the town itself," says Fales, who has written two books on Wilmington history. "My father ran a wholesale at 116 South Water Street, and when I was not in school I was down there with him," he says. "The only paved street we had then was cobblestone."

The cobblestones came from wooden ships that sailed into the harbor, casting overboard the stone ballast used to stabilize the empty vessels. The ships left with a cargo of cotton or turpentine; the townspeople

He's not as old, but he recalls 4th Street in the 1940s as a center of activity.

"On a day like today, this place would be just like the mall," says the man, who declines to identify himself. "There were gypsies telling people's fortunes for money and medicine men peddling medicine for corns."

An electric streetcar served the hustle and bustle in the city from 1893 to 1939.

There was five cents in it for you if you helped the driver change direction when the trolley reached the end of

remembers going down to the river bank with his mother to collect coal that the dredges had kicked up from the bottom. This excess coal that had spilled from barges during loading kept his family warm in winter.

The room is a haze of cigarette smoke, dust and late afternoon sun. Graham apologizes for leaving, but he has to go pick up his wife. He steps out into the bright light on the 4th Street sidewalk. Come back some other day when he's got more time, he says, and he'll really tell you some stories.

Mole Crabs: Can You Dig 'em?

Imagine spending your lifetime tumbling and scurrying about in a surge of sand and water.

Now you know how a mole crab feels.

As waves crash onto the beach and retreat, the egg-shaped crab pops out of the **swash**, races to a new spot and digs in the wet sand as a new wave breaks.

Watching this over and over again, you might think the mole crab a hapless creature. But this tiny **crustacean** is actually well-suited to its unstable home.

One of the few creatures that can survive in the **surf zone**, the mole crab adapts beautifully to its rumble-tumble life. Having no claws or pinchers, the crabs use feathery **antennae** on their heads to sift food from the water.

Its powerful legs help the mole crab burrow backward in a hurry. The crab orients itself to the outgoing wave so its antennae can filter plankton — tiny microscopic plants and animals — from the water.

You may notice a pattern of tiny Vs that remain on the sand as the water retreats from the burrowed crabs.

Meanwhile, these speedy crustaceans have predators from land, sky and sea. Mole crabs that are too slow make a mouth-watering meal for gulls and sandpipers hovering over them.

The crabs are also a tasty treat to fish such as pompano and flounder swimming in shallow waters. That's why experienced fishermen scout out soft-shelled mole crabs to bait their lines.

Next time you're at the beach, take off your shoes and let the surf lap at your bare toes. You might feel the tiny creatures scurrying around your feet as you wade.

Scoop up a handful of wet sand and you'll probably catch a few. They may tickle the palms of your hands but they can't bite you.

In the summer months, you may notice bright orange eggs clinging to the bellies of the females.

Another thing you may notice is how crabs of the same size tend to hang out together at the beach.

"The big crabs like to stay where the waves are crashing harder, and smaller crabs tend to be farther up the beach where it's calmer," says Lundie Spence, Sea Grant's marine education specialist.

Scout around, she says, and you should be able to find crabs of all sizes.

VOCABULARY:

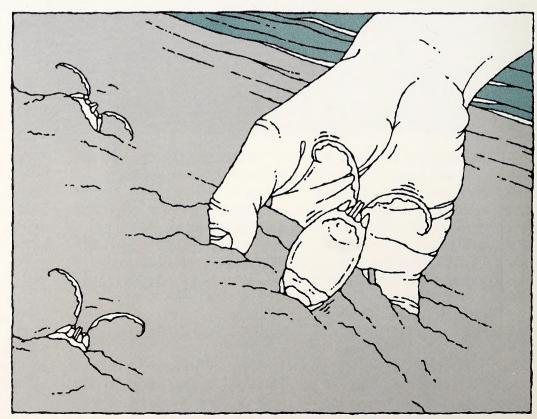
swash - swift, dashing water.

crustacean - one class of arthropods that usually live in the water and breathe through gills; they have a hard outer shell and jointed appendages and bodies.

surf zone - Area of the beach where the waves break and recede.

antennae - a pair of movable, jointed sense organs on the head of arthropods such as insects, crabs, lobsters, etc.

-- Carla B. Burgess



Natural Wonders of the Coast

The Plant With an Unusual Appetite

Charles Darwin called it "the most wonderful plant in the world."

The great naturalist had traveled the globe, seeking clues to the mysteries of plants and animals. Yet, no plant fascinated him more than the Venus' flytrap (Dionaea muscipula), a botanical marvel found only within a 75-mile radius of Wilmington, N.C.

No one has come up with a satisfactory answer as to why this strange plant does not prosper elsewhere, but legends abound. One traces the original flytrap spores to a wandering meteor that struck the earth millions of years ago.

Of course, that's hogwash to most botanists. But none can explain the flytrap's choice of habitat. They will tell you, however, that the Venus' flytrap, and other insectivorous plant species, are ideally suited to the low-lying, semi-bog savannahs common along North Carolina's southeastern coastal plain.

The soils in these savannahs are seriously lacking in the one nutrient essential for plant survival: nitrogen. Over millenia, the Venus' flytrap and its cousins developed ways of snaring insects to supplement their diets, thus getting the much needed element.

In the Croatan National Forest near New Bern, biologist Wayne Starnes keeps a careful watch over these unusual plants.

> Over millenia, the Venus' flytrap and its cousins developed ways of snaring insects to supplement their diet, thus getting the much needed element.

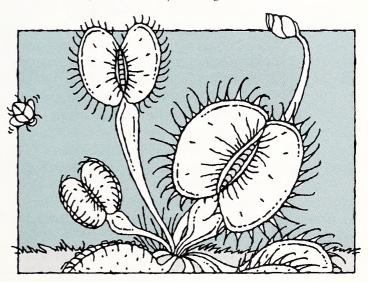
"They are extensive over the southern part of the forest," he says. "They love the little shallow areas between the sandy uplands and the mud bottoms."

Starnes says the plants are not endangered, but are considered "sensitive." They are protected by policy, but not by law. People who take them from the national forest can be fined, he says.

Contrary to popular belief, Venus' flytraps do not actually "eat" their prey. A small insect crawls onto the flytrap's oval

leaves — perhaps attracted to the leaf's bright red lining tickling the tiny hairs that coat the surface.

This action encourages the flow of juices stored under pressure inside the plant, releasing the woody tissue hinge that holds the plant's "jaws" open. The sides of the leaf snap shut, often in less than a second, creating a cellulose prison. Over several hours, the released juices digest the insect.



Dionaea muscipula

Oddly enough, the tiny hairs on the leaf's surface require two "tickles" to begin the trapping process. This prevents the plant from closing on a dead leaf or other inanimate object.

The Venus' flytrap spreads its leaves close to the ground. In May or June, the plant shoots tendrils about a foot into the air. On these tenderils grow small white or yellow blossoms.

Many people touring the southeastern area of North Carolina refuse to go home without buying at least one sample of the amazing insect-eating plant. Plant stores and roadside stands sell Venus' flytraps and bulbs that have been propagated in private nurseries. Jimmy Northrop of Northrop Insectivorous Plant Farm near Wilmington ships them around the world.

Someone once remarked that the existence of plants such as the Venus' flytrap has given rise to fictions involving "maneating trees" and other hungry greenery.

But who needs fiction when the truth is strange enough?

--- C. R. Edgerton

Extending Knowledge to the Coastal Community

Relief For Ailing Shores

As long as there have been wind and waves, there's been coastal erosion. But people have made the problem worse. Our intensive use and mismanagement of estuarine shoreline has created even more of a need to preserve its condition.

Methods of controlling estuarine erosion — such as bulkheads, groins or breakwaters — are as diverse as the shoreline itself. A number of them work. Others are ineffective. Some are even environmentally detrimental. And all are expensive.

Sea Grant is looking at a new strategy, breakwater-marsh, which actually combines two veteran erosion-control methods — offshore breakwaters and planted marsh.

"The method is combining very small wooden breakwaters with planted marsh grasses to provide a lower cost alternative," says Spencer Rogers, Sea Grant's coastal engineer. "It's perceived as an environmental asset because it turns an eroding shore into marshland."

The Albemarle-Pamlico Estuarine Study has recently provided some funding so that Rogers and selected property owners can construct marsh-breakwaters as demonstration models.

"Sea Grant has been doing research in marsh grass for erosion control for many years," says Rogers. Marsh grass plantings alone can control erosion in some sheltered areas. These usually control bank erosion for three to five years; some last even longer.

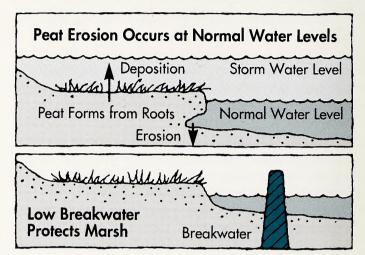
But used to control an eroding shoreline, marsh grass has its limitations. In areas of moderate to high wave activity, a short life is one of them.

The grasses develop a dense bed of stems that gradually dissipates waves, and form a root mat or peat layer that is very dense and erosion-resistant on the surface. But the outer edge of this peat layer is gradually undermined and eventually collapses and disappears.

Combined with a small breakwater that protects the outer edge of the marsh, grasses can be survive much longer.

"The purpose of the breakwater is purely to prevent the marsh erosion. It doesn't actually protect the upland," Rogers says. "The marsh or breakwater alone would not control bank erosion."

A good test of the combination occured unintentionally in the late 1970s on the Pamlico River west of Bath. The owners of a church camp, struggling to deal with their eroding shoreline, built an illegal wooden bulkhead. Before they



could backfill it, the state learned of the violation.

After some negotiation, the state allowed the camp to leave the structure in place as an offshore breakwater. A Sea Grant researcher planted some grasses behind one section; other grasses sprang up voluntarily.

"This breakwater was very low — about 6 inches above high water, and in water depths of 2 to 3 feet," says Rogers. "A marsh very rapidly became established, and it built up a good peat layer."

After the church sold the camp, the property was subdivided and purchased by individual owners who, unaware of its significance, removed the breakwater. Within six months, most of the marsh was gone; in two years it had completely disappeared. The bank erosion returned.

"Eventually all the property owners built bulkheads to protect the shoreline," says Rogers. "There's no marsh or beach now. And all that was needed to keep the marsh in place was this very low inexpensive breakwater."

Construction of marsh-breakwaters costs \$25 to \$35 per foot of shoreline protected, including the cost of planting marsh grass. Typical bulkhead prices range from \$40 to \$75 per foot.

All areas aren't suited to a breakwater-marsh, Rogers says. The method is most useful in areas where there's too much wave activity for marsh grasses alone to work.

To keep the cost reasonable, the offshore waters must be shallow — less than 3 feet deep 50 feet offshore.

The demonstration projects will be constructed in the northeastern part of the state during the next year.

--- Carla B. Burgess



Field Notes

Insights into Current Sea Grant Research

A Helping Hand for Nesting Waterbirds

Jim Parnell's a little worried.

Worried that a beachcomber's dog
might play deadly havoc with a nesting

colony of royal terns.

Worried that unwary children might think nothing of tramping through a pelican hatchery or use hundreds of bird eggs in a fight.

In short, he's worried that one careless human act could spell death for thousands of terns, gulls, skimmers and pelicans. He's hoping folks and their animals will leave shorebird nesting sites alone.

Since the early 1970s, Parnell, a professor of biology at the University of North Carolina at Wilmington, has been counting and studying North Carolina's colonial waterbirds, those that nest in colonies instead of individually. Now, with the counting done, he's recommending ways to manage them.

He'd hate to see two decades work come to nothing at the hands of people who just don't know what they're doing.

"These birds are still fairly common so they like to gather in large groups for nesting," he says. "That makes them susceptible to disaster."

Through funding from Sea Grant and other agencies, Parnell and colleagues have done away with at least one danger that these multitudes of birds once faced.

In the mid-1970s, he and Bob Soots of Campbell University discovered that many common colonial waterbirds built their nests on the numerous dredge islands along the Tar Heel coast.

These islands were the domain of the U.S. Army Corps of Engineers. They frequently dredged navigational



Jim Parnell

Photo by C. R. Edgerton

channels and dumped their spare sand on the islands, sometimes destroying the habitat desired by many of the nesting birds.

The Corps wanted to stop this destruction, but they didn't know when certain species of birds would be nesting on certain islands.

Enter Jim Parnell and Bob Soots.

Through their research, they identified not only the numbers of colonial nesting birds on the North Carolina coast, but they learned when they nest, where they nest and in which habitats the different species thrive.

The Corps of Engineers was glad to gain this knowledge. Now they use this information and plan their dumping and dredging in conjunction with the schedules of nesting waterbirds.

"It was a natural extension of our research," Parnell says. "My concern had been to institutionalize what we'd been doing in our research, to get established agencies to use the information."

The Corps program was so successful, the North Carolina Wildlife

Commission eventually got involved in waterbird management. Through it's non-game species program, the commission began to use Parnell and Soots' research to institute a program aimed specifically at protecting nesting colonies of waterbirds.

And, the National Audubon Society uses the information in managing its Battery Island refuge at the mouth of the Cape Fear River. One of Parnell's former graduate students manages the refuge.

"So, both public and private lands are being managed with our research and suggestions," Parnell says. "All this started with our initial Sea Grant work that was funded in the early 1970s."

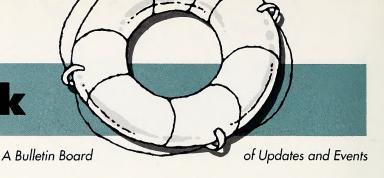
But the work doesn't stop here.

"We still need to learn to manage better," Parnell says. "We need further research on refining our waterbird managing techniques."

As the coast gets more crowded, management becomes more important," he says. "Now, more than ever, colonies of nesting waterbirds are vulnerable. It's up to us to protect them."

--- C.R. Edgerton

The Aft Deck



Copeland Chairs Board

Sea Grant Director B.J. Copeland has been named chairman of the South Atlantic Regional Marine Research Board. The South Atlantic Board is one of nine such regional boards established last year by federal legislation to protect the nation's water quality.

Each board will include nine members: three appointed by the National Oceanic and Atmospheric Administration, two by the Environmental Protection Agency and six by the governors of the states located in the region.

One of the NOAA appointees will always be a Sea Grant director, who will act as the chairman. Copeland was chosen by the administrator of NOAA.

The South Atlantic region includes North Carolina, South Carolina, Georgia, Florida, Puerto Rico and the U.S. Virgin Islands. North Carolina is also represented in the Mid-Atlantic region, which spans from North Carolina to New Jersey.

In their first year, board members will assess the coastal water quality of the region and develop a plan for protecting and improving it.

In subsequent years, the board may be given federal appropriations to fund research and extension projects that relate to water quality.

Proposals Flood Sea Grant Office

On April 4, the Sea Grant office in Raleigh needed a traffic controller as a barrage of researchers and messengers dropped by to deliver 1992-1993 research proposals.

At the end of the day, 43 proposals were stacked on the floor of Director B.J. Copeland's office. The proposals fell into five research categories: fisher-

ies, aquaculture, coastal processes, seafood technology and estuarine studies.

Copeland says he was happy with the scope and quality of research represented by this year's proposals.

The proposals will now undergo intense peer and state agency review. These reviews will dictate which proposals are selected for the Sea Grant omnibus proposal that will be presented to the National Sea Grant College Program in July.

Sea Grant Programs Help Reduce Deficit

The United States imports about half of the seafood consumed by Americans, resulting in an almost \$7 billion annual trade deficit.

Across the country, Sea Grant programs are funding research projects and extension programs aimed at reducing this deficit by increasing foreign sales of our own products.

Here are a few examples.

- A U.S. company called on a North Carolina Sea Grant specialist to assist them in developing harvesting technology for blue crabs in Turkey. Today, this company is selling more than 3,000 pounds of blue crabs per day to European markets, with profits accruing to the U.S. firm.
- Virginia Sea Grant worked with a seafood processing firm to develop at-sea chilling and handling procedures for scallops. The higher quality scallops now being produced by this firm are being sold in Europe and Hong Kong.
- Until recently the Japanese turned up their noses at the tuna available in the United States. It wasn't fresh enough for their raw fish market. Recognizing the problem, Sea Grant specialists along the East Coast began working with tuna fishermen to

improve their handling procedures. As a result, annual exports of fresh tuna have soared from less than \$300,000 to more than \$2 million in just five years.

- The Japanese import more than 7,000 tons of the seaweed, *Gracilaria*, every year for food and agar, a gelatinous product used as an additive in cosmetics, air fresheners and pharmaceuticals. In fact, so much of the seaweed is being harvested that natural supplies are dwindling. But Hawaii Sea Grant has supported basic research that may allow commercial cultivation of the seaweed in fish ponds soon.
- To reduce the need for imported fishery products, Sea Grant scientists from Maine to Hawaii are improving culture techniques for these species: mussels, clams, oysters, scallops, hybrid striped bass, crawfish, salmon and prawns.

Buying and Cleaning Soft Crabs

For many seafood connoisseurs, there's no greater coastal delicacy than a soft crab battered and fried.

If you have a hankering for these soft crustaceans, then late spring and early summer is the time to feed your need for this seasonal catch.

You can buy soft crabs from seafood markets or from fishermen who shed the crustaceans for \$1 to \$2 each.

Soft crabs should be bought either alive, freshly dressed or frozen, says Sea Grant seafood education specialist, Joyce Taylor.

If you buy them alive, be sure to clean them before cooking, Taylor says.

To clean, use kitchen shears to remove the eyes and mouth by cutting across the body just behind the eyes. Turn the crab on its back. Lift and remove the apron and vein attached to it.

Turn the crab over and lift one side of the top shell. With a small knife, scrape off the grayish-white gills. Repeat on the other side. Rinse with cold water and pat dry.

Never store freshly dressed crabs in the refrigerator more than one day, Taylor says. Crabs have a short shelf life and spoil easily. It's best to use the crabs the day they are bought.

Although most coastal cooks prefer to fry their soft crabs, the cushy crustaceans can be baked, broiled, grilled, stuffed and used with sauces. Here's a recipe for you to try.

Stuffed Soft-Shell Crabs:

8 soft-shell crabs, cleaned

1/4 c. chopped onion

1/4 c. chopped celery

2 T. chopped green pepper

1 clove garlic, minced

1/4 c. melted margarine

1 c. cracker crumbs

2 T. milk

1 beaten egg

1 T. chopped fresh parsley

1/2 tsp. dry mustard

1/2 tsp. Worcestershire sauce

1/4 tsp. salt

1/8 tsp. cayenne pepper

1/4 c. melted margarine

Sauté onion, celery, green pepper and garlic in margarine until tender. In medium bowl, combine sautéed mixture with crumbs, milk, egg, parsley, mustard, Worcestershire, salt and cayenne. Place crabs in a shallow, well-greased baking pan. Remove top shell from crabs, and fill each cavity with stuffing mixture. Replace top shell. Brush crabs with melted butter. Bake at 400 degrees for 15 minutes or until shells turn red and crabs brown slightly. Serves 4.

Big Sweep T-shirts HOT OFF THE PRESSES

North Carolina is celebrating the Big Sweep '91 with a brand new cast of characters.

"The Big Sweep Bunch" makes its debut on our white, all-cotton T-shirts, hot off the presses. Against a vivid splash of aquamarine, these five litter-



busters lead the attack on shoreline pollution.

The girl and boy, along with their aquatic animal companions, fish, bird and turtle, have their hands full — of cups, plastic and other throwaways. And you will too, if you join them in helping to clean our littered waterways.

This year's Big Sweep is Sept. 21. Join the Big Sweep Bunch by ordering your T-shirt now. They're available in a variety of sizes for children and adults, priced at \$7 and \$8.

Children's T-shirts come in small (6-8) and medium (10-12), and cost \$7 each. Adult sizes, small (34-36), large (42-44) and extra large (46-48), cost \$8.

To order, write The Big Sweep, Box 8605, North Carolina State University, Raleigh, N.C. 27695. Checks should be made payable to The Big Sweep. Include \$1 per shirt for postage and handling. Please specify size and quantity.

Big Sweep '90's Dirty Dozen

The Dirty Dozen has finally emerged from the 165 tons of trash picked up across North Carolina during Big Sweep '90.

After analyzing the data recorded by the 10,000-plus volunteers who cleaned the state's waterways, the Big Sweep has come up with the 12 most prevalent shoreline litter items.

Cigarette butts, new to last year's data cards, were number one – volunteers picked up 77,080 in all. The filthy filters accounted for 19 percent of all the trash items collected.

Metal beverage cans came in second, with 25,443 retrieved. Glass and plastic beverage bottles followed in third and fourth places, respectively, with 24,073 and 20,704 recovered.

Paper pieces ranked fifth at 17,350, plastic pieces sixth at 16,624 and plastic foam pieces seventh at 15,060.

Plastic food bags represented 12,719 pieces of litter and the number eight item. In ninth place was plastic foam cups – 11,889 were picked up. Pieces of glass – 11,302 of them – came in at 10th place. Metal bottle caps ranked 11th, with 9,282 collected. And the 12th most prevalent item – representing 9,208 pieces – was plastic caps and lids.

Boating Tips for CleanerWater

As a boat owner, you can do a lot to preserve the water whose resources you enjoy so much.

Remember the following rules of the aquatic road.

- Use onshore restrooms and pump-out facilities when possible. Never release garbage or raw sewage from your boat.
- Keep a trash container on board, keep it covered and make sure everyone on board uses it. If you dispose of your garbage at a marina, follow their recycling rules.
- Avoid bringing disposable plastic products on board.
- Make it a rule that no trash goes overboard, including old fishing line.
 - Retrieve trash found in the water.
- Make sure your motor is not leaking gas or oil. Don't drain engine fluid into the water. Be careful not to spill when adding oil to your engine.
- Place a bilge pillow an oilaborbing sponge available in marine stores — in your bilge to remove oil from your bilge water.
- Clean your boat with nonphosphate detergent and a scrub brush. Avoid using toxic polishes or stain removers on or near the water.
- Obey posted speed limits, and go slow near banks that your wake can erode.

From Earth Guide: 88 Action Tips for Cleaner Water, published by the Connecticut, New York and New Jersey Sea Grant programs.

Coastwatch encourages readers to write concerning topics relating to North Carolina beaches. We also seek feedback on articles and features appearing in the pages of Coastwatch. Letters should be no longer than 250 words and should contain the author's name, address and telephone number. Send all correspondence to Coastwatch, UNC Sea Grant, Box 8605, North Carolina State University, Raleigh, NC 27695. Letters may be edited for style. Opinions expressed on this page are not necessarily those of UNC Sea Grant employees or staff.

Sharks and Rays at The Point

Dear Coastwatch,

Many years ago, about 10, we were on The Point (at Buxton) when local netters brought in their catch in their nets.

I can never forget the giant manta or sting ray (and I mean giant!) that they left on the beach to die, along with all the sharks.

I know they are hardened salts, and it is hard to change them. I think they are not allowed to net at The Point anymore. I know how dangerous the rays are (my husband was stung by one!), but can anything be done about this?

I respect the fishermen and their ways, but what can be done? I will never forget that ray trying to get back to the water.

Sincerely, Mrs. James W. Morrison, Wayne, Pa.

You are correct, it is illegal to use a net to catch fish at The Point at Buxton. For those who may not know, The Point is that narrow sand spit that juts farthest into the ocean at Cape Hatteras.

It is a shame that the fishermen you witnessed allowed the ray and the sharks they caught simply to die on the beach. They may have been afraid of the creatures or the large ray may have been too heavy for the fishermen to lift.

They probably did not know that both of these fish are edible. The shark, in fact, is a marketable fish.

Sea Grant research has shown that skates and rays are a little known delicacy of the seas.

Many fishermen reject these broad, flat fish because they are considered a nuisance. This prejudice is a result of the fish's ugly appearance and the idea that they are dangerous because of their long, stinging tail, says Sea Grant researcher David Griffith.

In reality, skates and most rays are less dangerous than bluefish, for example. Skates do not have stingers, but a few species of rays have barbed stingers on their tails. These barbs contain a toxin that can cause painful puncture wounds. If you catch a ray, exercise caution and cut or clip off the tail.

For a free copy of our brochure about how to catch and prepare skates and rays for the table, write to us at the above address

Our First Paid Subscriber!

Dear Coastwatch.

I know the first new 16-page magazine is free, but I hope I'm the first to send in a subscription for the balance. It's well worth it.

I've been participating as a *Coastwatch* recipient and sponsor for about 10 years now and aim to continue as long as your good work does. Sign me up!

Again, thanks and keep up the good work. Sincerely, Cornelius Cummings, Allentown, Pa.

Coastwatch Survey Revealing

We learned a great deal about our readers in a recent survey of randomly selected *Coastwatch* subscribers.

We found that you liked our newsletter but would support an expanded magazine format.

We also discovered that most of you are older than 35 years, have subscribed to *Coastwatch* more than three years and share your copy with others.

The survey confirmed our belief that you are very concerned about what's happening on North Carolina's coast. Most said water quality and rapid coastal development are the major issues facing the coast in the 1990s. In your opinion, other important issues include tourism, coastal research and aquaculture.

We asked you about the job we do here at *Coastwatch*, and here's what you think. You like the way we focus each issue on a single topic. You would like to see more pages per issue, more in-depth reporting, more nature writing and more information about the results of Sea Grant research.

The magazine you hold in your hand is the result of your views about *Coastwatch*. We hope that you enjoy the changes and that you continue to let us know how you feel about what we're doing. Most of all, we hope you will continue to support our magazine by subscribing.



Book Store

Publications to Enrich Your Coastal Library

Almost everyone makes a trip to the beach during the summer. Why not use a little of your beach time to learn more about this salty environment. If you want to know how to spot a rip current or identify a shell, send for these Sea Grant selections.

SEASHELLS BY THE SEASHORE

No day at the beach is complete without a shell search at the surf's edge. We're all attracted to these wonders of molluscan architecture, but how many of us know a coquina from a cockle?

To identify the shells you collect, send for a copy of *Seashells Common to North Carolina.* This 36-page booklet lists more than 100 shells frequently found along Tar Heel beaches.

Most listings have a brief written description of the shell and an accompanying photograph or drawing for easy identification. The guide can be used on the beach or in the classroom.

For a copy, write Sea Grant. Ask for UNC-SG-72-09. The cost is \$2.

RIP CURRENTS

This poster can save your life.

Rip currents can be deadly if you don't know how to spot them and how to get out of them.

Sea Grant's Rip Current

Poster, 11-by-28 1/2 inches, explains what causes the dangerous currents, how to detect them and what to do if you're caught in one.

This valuable information saved the lives of a Charlotte woman and six swimming companions. It can save yours too.

For a copy, write Sea Grant. Ask for UNC-SG-86-09. The poster is free, but please enclose \$1 to cover postage.

DELIGHTFUL DUNES

Dunes are a beautiful backdrop to the roaring ocean. But the sandy mounds and the plants that stabilize them offer more than beauty.

They offer protection. They buffer inland areas from wind, waves, tides and storms.

Although sand makes the dune, vegetation holds it in place. And the plants that stabilize dunes have some special adaptive features that enable them to withstand the harsh beach environment.

To learn more about the ecology and biology of our coastal dunes, send for a copy of *A Guide to Ocean Dune Plants Common to North Carolina*.

This 72-page guide will teach you about dune habitat and the plants – trees, shrubs, vines, herbs and grasses – that call this environment home. It contains more than 50

botanically accurate drawings of dune plants frequently found on Tar Heel beaches.

For a copy, write Sea Grant. Ask for UNC-SG-87-01. The price is \$4.50.

SALT MARSH PLANTS

As a companion to our dune plant guide, Sea Grant offers a smaller, but equally informative *Guide to Salt Marsh Plants Common to North Carolina*.

This guide describes the plants that live in the brackish tidal waters of the salt marsh. Like their cousins on the dunes, salt marsh plants also have some special features that allow them to adapt to the tidal marshes.

To identify the marsh plants, this guide also includes botanically accurate drawings of more than 25 shrubs, vines, herbs and grasses.

For a copy, write Sea Grant. Ask for UNC-SG-81-04. The cost is \$2.

HOT OFF THE PRESSES

When it comes to soft crabs, demand still exceeds supply.

But Sea Grant agent Wayne Wescott has developed some new technology that may increase supply of these soft crustaceans.

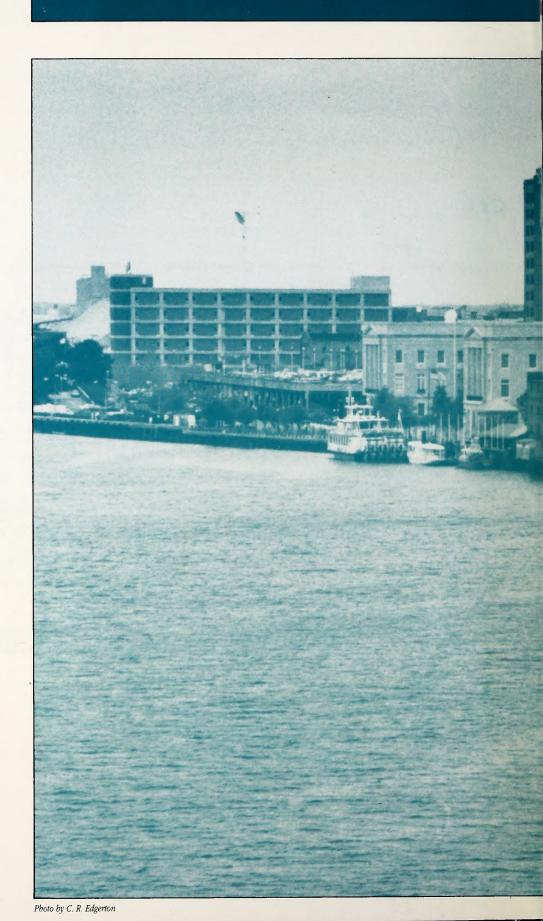
Until recently, thousands of miles of waterfront property were unusable for soft crab production because of poor, murky water. In some areas, water was so turbid that the gills of peelers being held in shedding trays would clog and the pre-molt crustaceans would die.

Now, Wescott has developed a pool filtration system that will remove suspended sand, silt and debris from the water of flow-through shedding systems. Used in marginal water, the same filtration system prolongs the holding time for peelers.

To learn how to construct a filtration system, send for the four-page illustrated Blueprint, *Improved Flow-Through Shedding Using Sand Filtration*. Ask for UNC-SG-BP-91-02. It's free.

When ordering Sea Grant publications, please use your mailing label from Coastwatch or the customer identification number that appears above your name. This will speed delivery. Also be sure checks are made payable to Sea Grant unless otherwise specified.

Send all publication requests to: Publications, Sea Grant, Box 8605, North Carolina State University, Raleigh, NC 27695. If you wish to order multiple copies or need further assistance, contact Carole Purser, publication distribution manager, at 919/737-2454.



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Coastwatch

Coastwatch Staff:

Kathy Hart, *Managing Editor*C.R. Edgerton and Carla B. Burgess, *Staff Writers and Editors*L. Noble, *Designer*Julie Snyder and Debra Lynch, *Circulation Managers*

The University of North Carolina Sea Grant College Program is a

federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, UNC Sea Grant supports several research projects, an 11-member extension program and three communicators. B.J. Copeland is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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From The Top

Dear Readers:

Thanks for subscribing to Coastwatch. We look forward to providing you a year's worth of reading pleasure.

For this issue, we're focusing on coastal aquaculture.

At Sea Grant, folks frequently drop by or call to ask questions about raising hybrid striped bass, catfish or crawfish or about growing shellfish on leases.

Some are farmers looking for alternative, more profitable crops. Others are entrepreneurs searching for a sound investment that will yield substantial profits.

Many see aquaculture as the way of the future. As wild stocks of fish and shellfish are overfished or contaminated by pollution, aquaculture is frequently seen as a growing source of "safe" seafood products.

Gambling on this prophecy, many North Carolinians are digging ponds or obtaining leases to become farmers of the sea.

In Beaufort County, C.R. Edgerton learned what it takes to grow the latest entry into the aquaculture industry — the hybrid striped

bass. He visited two farmers who have traded their fields for ponds.

Edgerton also traveled Carteret County backroads with Sea Grant extension agent Skip Kemp to find out why there is so much interest in shellfish culture.

Carla Burgess visited South Brunswick High School where aquaculture is part of the curriculum. She learned from a North Carolina State University scientist how to make the garden grow with some fishy byproducts. And an extension specialist showed her a barn dedicated to fish culture.

I took on the task of investigating crawfish and catfish culture. Crawfish, a long-time Cajun favorite, are finding a home in Tar Heel ponds. And farm culture has elevated the catfish from the river bottom to haute cuisine

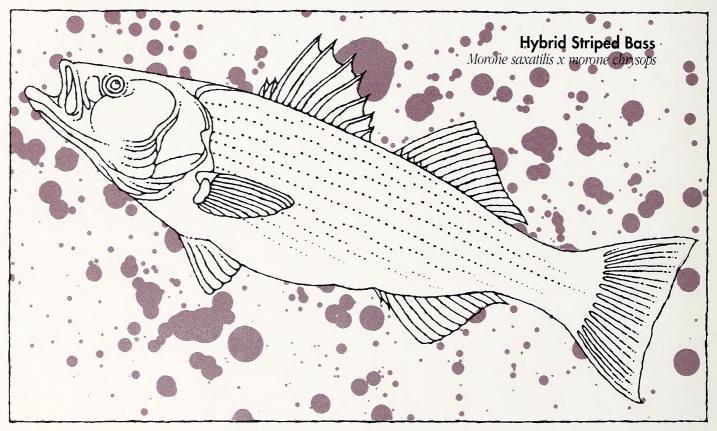
We hope you enjoy learning about the culture of fish and shellfish. If you would like to know more, be sure to contact the sources listed at the end of each article.

See vou next issue, Kathy Hart

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Eastern North Carolina: A Hotbed for Hybrid Bass



By C.R. Edgerton

The striped bass is a species in

Legendary for its size and strength at the end of a rod and reel, the "rockfish" is not often seen in its natural habitat.

Overfishing and poor water quality have taken their toll.

But in Aurora a hardy hybrid of this prized fish is doing quite well.

Aurora is like any other small town in America.

When the guy down the road finds a new way to make money on the farm, the neighbors prick up their ears.

Three years ago, Lee Brothers successfully harvested and sold North Carolina's first batch of hybrid striped bass.

The neighbors swarmed Brothers like a bee on honey.

Within two years, four other area farming families had made commitments to raise hybrid bass in ponds.

Now some folks call this small town "the hybrid striped bass capital of the state."

"I just saw hybrid bass as a good opportunity several years ago," Brothers says. "The wild catches of striped bass were declining, and I figured the demand would be there."

He was correct.

In his first year of operation, his fish were grabbed up by fish dealers along the East Coast. The price was very good.

Now, Brothers has 30 ponds stocked with 600,000 fish. It's a job that leaves him little time for anything else.

"You don't get any sleep," he jokes. "The fish literally have to be watched 24

hours a day, especially during the summer."

Because of his pioneering efforts with hybrid bass, Brothers has become a guru to others who wish to follow in his footsteps.

But new producers mean new competition. And competition means lower prices.

"I developed my markets by trial and error and mostly on the telephone," Brothers says. "Over a period of years, I've gotten good markets, and I try to hold on to them. But there's one thing I can't change, and that's the price. If more people are selling fish, the price is going down."

When he started, Brothers was getting about \$3.50 per pound for his fish. Today, it's about \$2.45.

Brothers' competition comes mostly from people he's known all his life.

People like Nancy Tyndall.

"Farming is a tight business," says the 34-year-old Tyndall, sitting in a restaurant she owns next to Highway 33. "You've got to diversify. There's no way to make a good living from just selling beans,

"It's one of those projects that Sea Grant took a chance on back in the late 1970's, and it turned into something." Ron Hodson

potatoes and corn."

She's convinced her dad and mom and three brothers to set aside about 200 acres of the family farm for hybrid bass grow-out ponds.

The first of an expected 60 ponds was finished May 10 and filled with 50,000 fingerlings in mid-June.

From here, the sky's the limit, Tyndall says.

"Sure, it's a big investment," she says. "But from all we've checked into, the

rewards will be great. It should pay off. That's why we're doing it."

Tom Ellis agrees.

As the N.C. Department of Agriculture's director of aquaculture and natural resources, Ellis sees a bright future for hybrid striped bass in the Tar Heel state.

"We've got about 75 ponds in production right now, and we're going to see that number grow significantly," he says. He expects about 150 ponds by this fall and 400 by next fall. Ponds average from three to six acres.

"And I think it's safe to say that this will increase even though the price per pound will go down," he says.

Ellis says the current rush to get into hybrid bass production will ease over the next few years, especially as the "less efficient people fall out" of the marketplace.

Most hybrid striped bass farmers in North Carolina purchase their fingerlings from hatcheries in other states, including Florida, Arkansas and Tennessee.

In North Carolina, only the Brothers

Continued

Holding tanks at the Pamlico Aquaculture Center, Aurora, N.C.





Nancy Tyndall and her first hybrid bass growout pond.

operation produces hybrid striped bass fingerlings for its own use.

But setting up hatcheries won't become a reality until scientists can make a breakthrough with broodstock, Ellis says.

"Right now, we're getting our broodstock from the wild," he says. "What we're after is the ability to control broodstock to spawn at any time of the year. That way, we can leave the wild fish alone."

UNC Sea Grant researchers Ron Hodson and Craig Sullivan are leading the way in hybrid striped bass broodstock research (see related article on page 17). "Their work may open up this industry in three to five years," Ellis says.

"It's true; hybrid striped bass production is going to be a major industry," says Hodson. "It's one of those projects that Sea Grant took a chance on back in the late 1970s, and it turned into something."

Hodson credits the foresight of Sea Grant Director B.J. Copeland and former researcher Howard Kerby for the success in North Carolina's hybrid bass research.

"Ours was the first study to examine hybrid striped bass in ponds," he says. "All the striped bass work in the country started in the late 70s and, before we started, the hybrid had been raised in cages, but not in ponds."

From that initial research, the body of knowledge grew by leaps and bounds. By

The North Carolina coastal plain is an ideal site for hybrid striped bass production.

1985, Sea Grant was extending this knowledge to farmers, and by 1987, with the help of the National Coastal Resources Research and Development Institute, the nation's first hybrid striped bass pond culture was set up on the Brothers farm.

"We'll look back in history and point to that event," Hodson says. "That was the start."

And what a start it was.

During the winter of 1988-89, Brothers harvested and marketed his first crop of hybrid striped bass. Last year, with three other farmers hopping onto the hybrid bass bandwagon, about 120,000 pounds were produced in North Carolina. Nationally, more than 3 million pounds were produced and marketed.

"And the industry could easily expand to thousands of acres of productive water in North Carolina," Hodson says.

The North Carolina coastal plain is an ideal site for hybrid striped bass production. "We have lots of water; flat, clayey soil; and a good climate," Hodson says. "And we're fairly close to northern markets."

But there are problems.

One major hurdle in hybrid bass production is what Hodson calls "closing the loop," or having complete control of the life cycle of the hybrid.

Although total control has been accomplished with most cultured fish, a major breakthrough in that area hasn't occurred with hybrid striped bass.

"We still have to go to the wild for both white and striped bass, the two components of our breeding program," Hodson says. "We'll be able to close the loop when we have developed a domesticated broodstock. Until we do that, we can't do anything about genetic selection, which has advanced the production of other species like trout and catfish."

Until that cycle is under control, the hybrid bass industry will not advance rapidly.

"We're at the mercy of state and federal agencies who see us taking a limited resource from the wild," he says. "And, until we have domesticated broodstock, this won't get anything but worse."

Some progress has been made.

C.R. Edgerton

For two years Hodson and Sullivan, an assistant professor in zoology at North Carolina State University, have refined the process of administering the hormones needed for striped bass spawning. Their work has been supported by Sea Grant, the National Coastal Resources Research and Development Institute, and the N.C. Agricultural Research Service.

Meanwhile, because striped bass females spawn for the first time when they are about 5 years old, it takes longer to develop a stock of sexually mature fish that can be used in experiments.

"It may take another five years before we can close the loop," Hodson says. "That's when we'll be able to say to the farmer out there: 'Here's the way to do it."

Hodson and Sullivan are hoping farmers involved in hybrid striped bass production will continue their own brand of hands-on research.

"These farmers are impatient," he says. "They'll be working on developing their own ways of domesticating broodstock."

For example, Lee Brothers developed a hatchery and spawned a few fish this year.

"We had some success, but we realize it's a slow process," Brothers says. "We'll keep working on them."

Hodson says there's a difference in



Andy Ginnett tags a mature female hands-on research and the kind of research he and Sullivan are doing.

"They may get something to work for them, but they won't know why it's working," he says. "That's where we come in. We will be able to provide a scientific basis for broodstock development."

Tom Ellis says the state's Department of Agriculture is encouraging research into broodstock domestication.

"We need to be able to control the quality of the fish," he says. "And we need to get out of the hunter-gatherer mode and more into the agricultural side. If aquaculture can produce without competing with recreational fishermen, it makes it

all the better."

Hybrid bass farming is not without pitfalls. Fish farmers must be willing to manage their ponds intensively, spend money and time, and heed good advice.

A lack of a coordinated marketing system could also hinder hybrid striped bass production in the next few years. Ellis says most hybrid bass producers in the state have to create their own markets, as Brothers did.

"And another thing is that we still don't understand all the environmental factors for hybrid bass," Hodson says. "The riskiest time is when they are harvested and handled. We still don't know enough about it."

A key to success in this early stage is for growers not to set their sights on what they're getting per pound today, Ellis says.

"As more people get into it, the price per pound will fall. But still, it's such a high quality fish, it's going to sell."

Despite the drawbacks, Hodson recommends that people interested in fish farming give hybrid striped bass a try.

"They need to ask themselves is this something they really want to do," he says. "Then they need to read everything they can about hybrid striped bass. You don't have to be a biologist or have a background in biology to do it. In fact, the only way to learn is by being willing to put in the time it takes to do it."

Ron Hodson checks striper eggs.

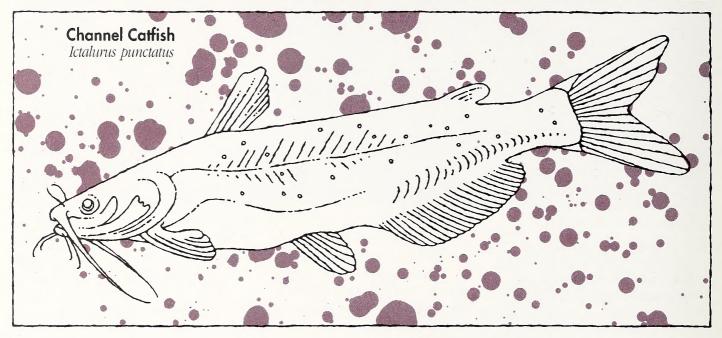
For more information about hybrid striped bass culture contact Ron Hodson at 919/515-2454. Hodson's manual, Raising Hybrid Striped Bass in Ponds, is available for \$6 from UNC Sea Grant, Box 8605, NCSU, Raleigh, NC 27695. Ask for publication number UNC-SG-91-05.





C.R. Edgerton

Keeping Catfish Down on the Farm



By Kathy Hart

Below the Mason-Dixon line where grits, fried chicken and iced tea reign king, there's no truer sign of regional cooking than a plate heaped high with golden fried catfish, commeal hush puppies and french fries.

In fact, true Southerners, those born and reared in the heart of Dixie, make pilgrimages to family-style fish camps perched on banks of muddy rivers to feed their cravings for this fried catch.

Outside of the South, the catfish's image doesn't fare so well. In other areas, the whiskered finfish is seen as a lowly river-bottom scavenger, whose muddy flavor makes it unfit for the table.

But people who think catfish aren't good eating haven't run their taste buds across a mild-flavored, farm-raised fillet fresh from the oven.

Yes, aquaculture has taken the catfish from the river bottom to the farm pond, making it a delectable choice at up-scale restaurants, in supermarket seafood counters and on the plates of a growing number of Americans.

In fact, channel catfish are the most successful aquaculture species in the United States. In 1989, 340 million pounds of the finfish were seined from farm ponds located mainly in the Mississippi Delta.

But as the popularity and use of the delicately flavored fish grows, so does interest in its culture. And North Carolina farmers and entrepreneurs, quick to see the merit and possible profitability of catfish culture, are adding more ponds to the Tar Heel landscape.

In North Carolina, catfish growers have about 1,200 acres of ponds in production. Last year, these ponds yielded 2 1/2 million pounds of catfish; this year, the harvest is expected to weigh in at 4 million pounds, says Tom Ellis, director of aquaculture and natural resources for the N.C. Department of Agriculture.

Large producers of catfish in North Carolina consider the culture of the finfish a full-time business. Their ponds measure from 10 to 20 acres, are stocked with 5,000 or more fish per acre and are intensely managed to maintain good water quality, to promote growth and to prevent disease.

Others raise catfish as a hobby or source of supplemental income.

Channel catfish is the species of choice for most culturists in North Carolina and other states. Other species can be raised but don't produce high yields.

Most Tar Heel catfish growers are specializing in grow-out production. They stock their ponds with young catfish, called fingerlings, that measure 5 to 7 inches in length. Then they raise the finfish to a harvest size of 1 1/4 to 2 pounds, says Steve Rawls, an area aquaculture specialist with the N.C. Cooperative Extension Service.

Neil and Diane Bowen, owners of Swindell Fish Farms in Pantego, have just finished harvesting the second crop of catfish from their 48 acres of ponds and are ready for their third stocking of fingerlings.

Neil says the couple has learned a lot about fish production and hard work since beginning their operation two years ago.

"A lot of people think you throw those little fish in the pond and then go back nine months later and harvest them," Neil says. "There's a lot more to it than that."

From March until November, the prime growing season for catfish, the Bowens spend long days keeping their ponds in top shape for their fishy crop.

They watch the levels of oxygen, nitrite, ammonia and pH in the ponds. They check their fish for diseases, which are common in intensive culture situations. And they keep an eye on the blooms of algae that color the water. Algae die-off in a pond can deplete the oxygen faster than a Southerner can say aquaculture.

"Water quality is our biggest concern," Neil says. "Any stress, particularly low

"As our estuaries and sounds and the fish that live in them are poisoned with pollution, more people are going to turn to the quality and assurance offered by farm-raised fish." Neil Bowen

dissolved oxygen, can cause fish to die. That's why in the summer I'm at the ponds until twelve, one or two in the morning moving aerators and checking DO (dissolved oxygen) levels."

Do the Bowens regret the day they dug their first pond?

"Absolutely not," Neil says. "We plan to hold at the acreage we have for awhile, then expand in a couple of years. We could potentially have 1,000 to 1,200 acres of ponds in production."

Neil's enthusiasm for catfish lies in the profitability of the crop.

"It's much more profitable than growing corn, beans and wheat," he says. "On farmland, you make about \$200 an acre year in and year out. With catfish, you can make \$200 to \$1,500 an acre."

But poor management or a quirk of fate can just as easily send your bank account tumbling.

And the Bowens caution that it can take a few years of production to pay back the start-up costs.

Rawls and Ellis agree. Both tell potential growers that catfish culture can be profitable, but there are also a lot of costs, especially in the beginning.

In some cases, investors must purchase land, dig ponds, acquire equipment and buy fingerlings. Farmers, switching

from the plow to the pond, sometimes come out cheaper because they already own land and some of their equipment can be converted.

"I quickly tell people interested in investing in catfish that it is expensive and has limitations," Ellis says. "I'd rather they be discouraged from the first than invest their life savings blindly."

Ellis also tells potential producers to line up a market for their catfish before they "move any dirt for their first pond."

"There is a saying in the seafood business I always use," Ellis says. "It goes 'If you don't sell 'em, you smell 'em.'

The Bowens are contract growers for Carolina Classic Catfish Inc., the only large catfish processor in the state. All of the

product they harvest is sold to the company for processing in its Ayden plant.

In fact, most North Carolina catfish producers have contracts with Carolina Classic, a company dedicated to a high quality product, Ellis says.

And when it comes to competing with all those catfish marketed from the Mississippi Delta, quality is the factor that sets Tar Heel catfish apart, Ellis says.

Catfish harvested from the delta often have an off-flavor, which can be attributed to poor quality water. But that's not the case in North Carolina.

> So what does the future hold for this whiskered finfish?

Ellis predicts that in five years at least 5,000 acres of ponds will be in production. He's had five inquiries from processors considering the possibility of locating plants in North Carolina. And Southern States Cooperative Inc. is investing \$3 million in its Farmville feed plant to install equipment that will produce catfish feed.

Neil Bowen is looking expectantly to the future too.

"My wife and I think we got into this business on the ground floor," he says. "We really believe catfish and aquaculture is the hope for the future.

"As our estuaries and sounds and the fish that live in them are poisoned with pollution, more people are going to turn to the quality and assurance offered by farmraised fish."

For information on catfish culture and production, contact Tom Ellis at the N.C. Department of Agriculture (919/733-7125).

Cajun Favorite Comes to Carolina

By Kathy Hart

The national popularity of Cajun cooking has boosted the image of the lowly crawfish. The once maligned, swamp-loving crustaceans have risen to new heights in culinary use.

Until 10 years ago, most Southerners used the small lobster-like crawfish for bait. They called them crayfish or crawdads.

But in south Louisiana, where the swamps run deep and the 'gators grow big, crawfish are as revered at Cajun tables as hot peppers and red beans.

Now folks outside the Pelican State are developing a taste for this bayou favorite. And although Louisiana still reigns king in crawfish production, farmers in other Southern states are beginning to see this crustacean as a culinary delicacy and a cash crop.

Crawfish culture is the largest crustacean aquaculture food industry in the United States. In Louisiana, 70 to 100 million pounds of crawfish are harvested annually with 60 percent of that harvest coming from ponds.

Crawfish take to pond culture like babies to milk. They flourish in less than ideal culture environments. They eat a variety of plants and animals, reproduce often and numerously, and grow quickly.

In North Carolina, crawfish aquaculture is a fledgling industry, but one that is trying to make a splash among Tar Heel consumers.

At present, there are 14 crawfish producers in North Carolina harvesting from 180 acres of ponds.

These producers harvest about 100,000 pounds of the clawed crustaceans between March and the end of June, says Steve Gabel, an area aquaculture specialist with the N.C. Cooperative Extension Service. Most of their product is sold live by the pound inside the state.

In fact, the demand in North Carolina

exceeds the amount of product crawfish producers can supply, says Aubrey Onley Jr., president of the N.C. Crawfish Produc-

ers Association. Those kinds of economics have farmers taking a second look at the feisty crawfish.

"It's an excellent way to diversify your existing farming operations," Gabel says. "They're a low maintenance, low cost species to raise."

And they take less technical knowhow than raising

catfish or hybrid striped bass, Onley says. But you can't just dig a crawfish pond

anywhere. Gabel says you need flat land with

enough clay content to hold water. You also must be able to pump 100 gallons of fresh water per minute per acre of pond.

Ponds vary in size, but all are shallow, about 18 to 24 inches deep.

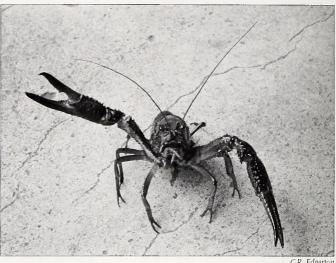
In most cases, producers stock their ponds once with sexually mature crawfish at a rate of 50 to 75 pounds per acre. At least 50 percent of the crustaceans should be female, but it is better if the ratio is 60 to 70 percent.

Unless water quality problems occur or a reproductive class is lost, crawfish will reproduce in ample numbers to restock the pond from year to year.

Red swamp crawfish is the species of choice for culture in the Southeast. It's hardy and lays an abundance of eggs. Some culturists also stock a small percentage of white river crawfish. But it is neither as hearty nor as prolific.

In North Carolina, crawfish are harvested between March and late June using traps that work and look like crab pots.

A producer never removes all of his stock. He leaves some behind to pare next year's crop. The crustaceans breed during



May and June, and the female holds the sperm until she lays her eggs.

In July, the producer begins draining his ponds at a rate of an inch per day. Meanwhile, the crawfish burrow in the muddy pond bottom. Eventually, they tunnel to a moist location just above the water table.

After the pond has been drained, the producer plants a forage crop - rice, grain sorghum or sorghum-sudan grass — to feed his crawfish when the pond is re-flooded. In most cases, the crop provides all the nourishment the crawfish need, and the producer doesn't need to supplement the crustacean's diet.

In her underground burrow, the female lays 400 to 700 eggs in August or September and holds them beneath her tail. The eggs hatch two to three weeks later but remain beneath the shelter of their mother's tail until the pond is re-flooded in late September or early October.

When the pond is re-flooded, the crawfish emerge from their burrows. During the fall and winter, they munch out on the forage crop and grow, periodically shedding their rigid exoskeletons.

By March and April, when it's time to harvest, the crawfish are a marketable size and sexually mature.

Sound easy?

It is, says Onley.

But one word of caution about the Cajun favorites: Watch the level of dissolved oxygen in the ponds. Producers should check their flooded ponds daily or every other day to make sure there is enough oxygen in the water to keep the crawfish alive. If oxygen levels get low, they should aerate the pond water.

"There's really only three ways to kill a crawfish," Gabel says. "You can poison them with an accidental spillage of pesticide, allow your dissolved oxygen to get too low or let something eat them."

At harvest, crawfish usually measure 3 1/2 to 4 inches in length. It takes 20 to 25 of the clawed creatures to make a pound.

But Onley says he trapped some crawfish in May that tipped the scales at a quarter pound each.

The production of crawfish per acre of pond varies from producer to producer, Gabel says. It depends on how intensively the producer has managed his ponds. But Gabel estimates the average production in North Carolina at about 500 pounds per acre.

For their efforts, producers could

expect \$2 to \$2.85 per pound this year, Onley says. That dollar figure is almost double what Louisianians get for their swampy catch.

Why the difference?

North Carolina producers offer a better product, Gabel says. There's no wild catch; all Tar Heel crawfish are farmraised.

And producers in this state purge their crawfish before they put them on the market. To purge, producers keep the crawfish alive and wet so the crustaceans will digest all of the food in their vein.

A purged crawfish translates to less cleaning before cooking for the consumer.

And what do consumers think of crawfish?

"Ninety percent of the people who try it like it," Gabel says. "But a lot of people are afraid to try something different."

The N.C. Crawfish Producers Association is working hard to introduce the Cajun favorites to Tar Heel diners. This year, the association sponsored crawfish boils at several locations across the state. At the N.C. Farmers Market in Raleigh, the association sold 1,100 pounds of crawfish in about an hour.

But in most parts of the state, the crustaceans are still a rarity on restaurant menus, in seafood markets or along

grocery store seafood counters.

"People have got to tell restaurants they want to see them on the menu," Gabel says. "And they've got to ask for them at the seafood market. You have to create demand."

Meanwhile, if you get a cravin' for the Cajun crustaceans, you can contact Gabel or the Crawfish Association (telephone numbers below). They'll send you a brochure that will tell you how you can get next-day UPS delivery of live Tar Heel crawfish.

What does the future hold for these Cajun imports?

Gabel and Onley say a better image, more producers, more crawfish and the possibility of research providing an extended harvest season.

For more information about growing crawfish, contact Steve Gabel at the N.C. Cooperative Extension Service office in Edenton. His number is 919/482-8431.

For more information about buying crawfish, contact Aubrey Onley Jr. with the N.C. Crawfish Producers Association at 919/426-9980. Or write N.C. Crawfish Producers Association, P.O. Box 1030, Edenton, NC 27982.



What does a crawfish taste like?

Crawfish producer Dr. Clancy Ballinger of Trenton Aquaculture says their taste is most like shrimp.

Aubrey Onley Jr., president of the N.C. Crawfish Producers Association, says their taste is a cross between shrimp and lobster.

"They have a real rich flavor," Onley

But Joyce Taylor, Sea Grant's seafood education specialist, says, "A crawfish tastes like a crawfish."

When it comes to eating, Ballinger prefers the crustaceans cooked the Louisiana way: boiled in spices. But Onley says the way to his heart is crawfish etoufeé.

How do you increase the value of a crawfish?

Allow it to shed its shell.

Buyers shell out \$10 to \$12 a pound for crawfish in their softened state.

Crawfish, like blue crabs, must shed their shells to grow. For a short time after they shuck their old duds, crawfish are entirely soft and can be eaten whole.

How do you find one of these cushy crustaceans?

When you harvest crawfish, you look for the signs of an impending molt and place these creatures in separate trays. When they do take it all off, you remove them from the tray and freeze them.

Aquaculture in a Class By Itself

By Carla B. Burgess

The sign outside Barry Bey's classroom proclaims aquaculture the wave of the future. With that in mind, a lot of his students are ready to "hang fin."

Take Eddie Shannon, for instance.

The 16-year-old sophomore enrolled in beginning aquaculture at South Brunswick High School last fall. It was a natural progression for Shannon.

"I've always liked fishing — it's my main hobby," he says. "I'm looking into going into the wildlife protection agency or just becoming a fish farmer."

After school, he works part-time on nearby fish farms doing whatever needs to be done — seining ponds to harvest or transport fish and cleaning the fish for sale to local restaurants. He has even helped a local fellow put in a bulkhead to control his pond erosion.

Shannon and the other students who attend Bey's vocational aquaculture classes are receiving a unique education — one that only a handful of high schools offer nationwide. At an early age, these students are getting helpful insight into the fast-growing aquaculture industry.

Shannon's classmate, Julie Lampe, 15, plans to put her expertise to work outside the classroom. Equipped with the hows and whys of aquarium maintenance, she hopes to be tending the fish tanks at the N.C. Aquarium at Fort Fisher this summer. Her goal is a career in marine biology.

In the combination classroom-and-lab, Bey's students have learned how to identify freshwater and saltwater species, how to recognize and treat fish disease, and how to manage water quality.

They have raised largemouth bass from eggs to adults. They've also reared fathead minnows, white bass, grass carp, bream, catfish, striped bass, tropical fish and frogs. They've even cultured cherrystone clams.

Outside of the classroom, they have applied their knowledge in ways that may eventually lead them to their life's calling.

When the ponds at a munitions depot at Sunny Point started drying out, it was Bey's students who joined the U.S. Army Corps of Engineers in rescuing and relocating the threatened fish.

As part of their community service duties, the students stock nearby Boiling Springs Lakes each fall with largemouth bass, bluegill and fathead minnows.

"It's become a legitimate career

program off and running. With an associate degree in wildlife management, three years work for the N.C. Wildlife Resources Commission and the design and development of his brother's catfish farm under his belt, he plunged into his first teaching job with no fear of the water.

The program was started on less than \$9,000.

"He's one of the leaders in high



ırla B. Bung

choice, not just an elective," Bey says of the four-year-old aquaculture program.

This model program has achieved celebrity not only in North Carolina, but nationwide. The class even captured the international spotlight last year during a television program, "Get Hooked on Aquaculture," which aired in the United States. Canada and overseas.

Bey has had no shortage of phone calls and letters from people in other states who want to know the secret of his success.

South Brunswick Principal Mose Lewis gets credit for the idea of a hands-on vocational education program about aquaculture. It made good sense in an area near 50 freshwater lakes and within 10 miles of the Atlantic Ocean.

"It had a lot of support in the community," says Bey. "Some of the first students came from fishing families."

Bey was responsible for getting the

school education," says Tom Losordo, aquaculture specialist with the N.C. Cooperative Extension Service. Losordo has been an advisor to the program, as has Douglas Holland, president of Brunswick Aquafarms.

"He's into education as much as he is business," Bey says of Holland, who uses the students in the afternoon to help with his catfish harvesting. "He set up in this area because we had the available labor."

And with more than 5,000 acres of catfish ponds predicted for this locale within the next two to three years, the job market for budding young aquaculturalists looks bright.

One of the first students to complete the program is now the assistant manager at a fish farm.

"We have had some of the kids go to Cape Fear Tech and take marine biology; one girl got a job with the EPA; some others work in pet shops," says Bey. "Some of them just go back to their families as commercial fishermen."

The most integral ingredient in South Brunswick's aquaculture program is the students, who have distinguished themselves by undertaking tough projects.

This year, they raised a tank of rainbow trout, a cool-water fish found almost solely in the mountains. The students were successful in keeping them alive despite warm climate.

But more impressive was their attempt this past spring to do a "reciprocal cross" of hybrid striped bass. In this experiment, usually attempted only by researchers and professionals, a female white bass and a male striped bass are used to achieve the hybrid.

The class decided to try the reciprocal cross because the broodstock was available. Though the spawning was unsuccessful —a trace of chlorine and uneven temperatures in the water killed the eggs — the students learned by doing.

"Even though the experiment failed, they got the learning experience from it," says Bey. "Next year, we can do it. We know the procedure now."

Bey's classes — which include a 12week, beginning and advanced course are a bundle of subjects in one. The program integrates science, business and even engineering. The students did all the plumbing and built all the stands for their 500-gallon circular tanks, aquariums and troughs, Bey says.

The class is not allowed to compete with local businesses, but their payoff comes in practical work experience. For example, the students maintain two ponds at nearby Walden Creek Fish Farm. They get local restaurants to buy from owner Tom Jones. With the money he makes, Jones pays the students to clean the fish.

Soon the students may have ponds to call their own. Plans are underway to construct four near the school's football field.

"They get the ideas and concepts here," says Bey. "Then they can go use what they know on the large farms."

A Barn Raising: Will it Pay Off?

By Carla B. Burgess

When it comes to studying the economics of aquaculture, North Carolina is staying in the swim of things.

At North Carolina State University, thousands of red tilapia make their home in five state-of-the-art re-circulating systems inside the largest demonstration model of its kind in the country.

It's called The Fish Barn, a project that may answer the question, "Is it economically feasible to raise fish in tanks?"

"We'll know in another year or so," says Tom Losordo in response to his own question. Losordo, an assistant professor of zoology and biological and agricultural engineering at NCSU, is the project's principal investigator and an aquaculture specialist with the N.C. Cooperative Extension Service.

In February, researchers stocked 3,375 tilapia each into four 5,500-gallon tanks and 1,800 into one 2,200-gallon tank.

Four types of biological filters, used to removed suspended solids and ammonia, are being tested in unique configurations for each tank.

Each tank can produce about 4,000 pounds of fish every six months.

Losordo says the system could be a good alternative production system for fish farmers "that don't have enough water to grow them in ponds or on the coast in an area where they can't get a permit to discharge the water to environmentally sensitive areas.

"They could run the small amount of wastewater into the sewer or use it on a garden," he says. "A thousand gallons of water would make a great lawn sprinkler and (would) be high in nitrates."

Each tank uses 100 to 500 gallons per day of new water and re-circulates 200 gallons per minute.

"The whole idea is to make it an energy-efficient and water-efficient system," he says.

But set-up costs can range from thousands to millions of dollars. That's why Losordo advises aspiring aquaculturalists to observe with optimism. but proceed with caution.

"All I say is wait. Let us spend the money first," he says. The N.C. Fish Barn represents about a \$150,000 investment.

The project is a joint effort of the N.C. Department of Economic and Community Development's Energy Division, N.C. Cooperative Extension Service, N.C. Agricultural Research Service and NCSU's College of Agriculture and Life Sciences.

On this early summer morning, Losordo has just led a tour of the barn for some N.C. Teaching Fellows. He's given more than 25 tours since its opening.

"It's used as a teaching facility for whoever wants to learn — a farmer, entrepreneur or students," he says. "The whole idea behind the project is to demonstrate state-of-the-art technology and educate the public.

"We're demonstrating technology and evaluating technology at the same time," he says.

Come fall, researchers will harvest their first crop of tilapia, which will be test marketed in the United States and Europe by corporate sponsors. Losordo says tilapia can bring \$1.25 to \$1.35 per pound wholesale, and up to \$5 a pound from gourmet restaurants.

The Fish Barn will be stocked with a second crop through the fall and winter, and researchers will attempt hybrid striped bass production next summer.

Other researchers, including some from other Sea Grant programs, are conducting experiments at the facility. A Louisiana State University researcher developed a prototype bio-bead filter that is being tested with the re-circulating tanks. "It's the first two of this size to be tried in the world," Losordo says.

This summer and fall, Losordo is conducting workshops that include a lecture on the theory behind the technology and four hours in the fish barn.

For more information about The Fish Barn, contact Losordo at 919/515-7587.

The New Greenhouse Effect: Growing Fish and Vegetables Side by Side

By Carla B. Burgess

With all the talk about chemicals in our food, excessive use of water and too much agricultural waste, it's easy to wonder if we can sustain ourselves without ruining the world.

A research group at North Carolina State University has slow-cooked a partial solution in a greenhouse.

It's called integrated aquaculturevegeculture. It employs all those concepts that have become politically correct in the 90s — "recycling," "organic," and "conservation."

The brainchild of Mark McMurtry, who received his Ph.D. in horticultural science from NCSU, the system involves growing fish and vegetables in a symbiotic relationship.

"Mark came up with the idea of intermittently applying fish waste to a sand bed and allowing this water to drain back into the fish tank," says Doug Sanders, a N.C. Cooperative Extension Service specialist who is project coordinator and professor of horticultural science at NCSU.

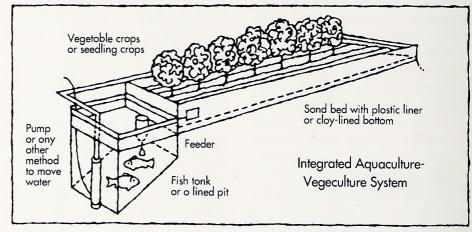
The pump removes fish feces and uneaten food that accumulates at the bottom of the tank, reducing the ammonia which can kill the fish. The wastewater is pumped into a planted sand bed that filters out the nutrients, simultaneously fertilizing the vegetables. The clean water is aerated and returned to the fish tank.

"The biofilter is the sand bed with the plants," Sanders says. "It cuts the ammonia and nitrate level in half, which is a reasonable level for the fish."

The system has produced tilapia, a hardy, disease-resistant fish native to West Africa, and tomatoes, cucumbers, lettuce and basil.

"We were able to grow all of these crops without any additional nutrients, and sometimes without liming or adjustment of the pH," Sanders says.

The system is profitable too. According to a paper written by



McMurty, Sanders and Sea Grant aquaculture specialist Ron Hodson, a one-half acre integrated greenhouse system can gross up to \$240,000, a net profit of about \$24 per square yard per year. A conventional vegetable greenhouse nets about 50 cents per square yard per year.

For each half acre, the integrated system can produce 92,400 pounds of fish, 110,000 pounds of tomatoes and 149,600 pounds of cucumbers per year.

It also provides year-round production of food with minimal water consumption.

"Water is added only to make up for evaporation and plant transpiration," says Sanders, adding that the water is recirculated 100 to 300 times. A given gallon of water is recycled repeatedly, staying in the tank 12 to 38 days.

The system conserves land resources through its intensified culture. It works in areas with poor soil and climate, and adapts to almost any region or culture.

It can be expanded for commercial use or scaled down for the backyard. McMurtry has drawn up a plan for high school teachers to use in developing demonstration projects for their students.

"It teaches symbiosis, re-circulation and conversion of nitrogen," says Sanders.

And what high-tech equipment would a teacher need?

"An aquarium, Rubbermaid dishpan and a pump," he says.

It can also teach small countries how to get more from their fishes and loaves.

The inhabitants of the small African country, Namibia, might use the system to raise their own native tilapia and produce a vegetable crop to feed their people. Sanders and McMurtry are working on a project that would export the system there.

But like any new idea, Sanders says it will take more time and experience to provide conclusive results to the public.

"I think it's something that has real potential," he says. "It will require a careful marketing plan to do this. There is a growing demand for tilapia."

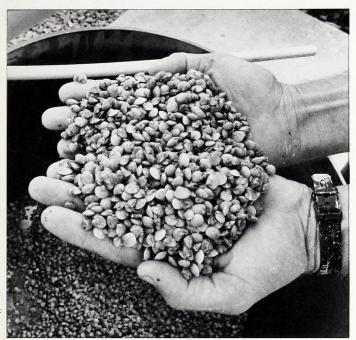
The research group is working on a new project to develop culture practices for "continually planting and harvesting fish and vegetables," Sanders says.

Meanwhile, a cooperator in Beaufort County plans to construct a 1/4-acre demonstration system near Bath.

"While we'll be doing some experimentation, their aim is to make it commercially feasible," Sanders says.

For more information about re-circulating systems, contact Sanders at 919/515-3283, or write IAVS Research Group, Department of Horticultural Science, Box 7609, NCSU, Raleigh, NC 27695-7609.

A Boom in Backyard Shellfish Farming



By C.R.Edgerton

When it comes to shellfish, everyone wants to get into the act.

Clam and oyster culture claim more adherents than any other type of aquaculture in the Tar Heel state.

"There's more demand for clams and oysters," says Tom Ellis, director of aquaculture and natural resources for the N.C. Department of Agriculture. "That makes shellfish aquaculture a more viable enterprise than ever before."

About 300 people hold shellfish culture leases in North Carolina's public waters, Ellis says. "That's more than all the other forms of aquaculture combined, including trout, catfish and hybrid striped bass."

Clams, oysters, even scallops are being raised in mostly small operations up and down the Tar Heel coast.

Yet, shellfish culture is still in its infancy, at least technologically.

"We're still in the gatherer stage with shellfish," Ellis says.

And there are other problems. Fish are raised primarily on private land, but shellfish must be cultured in public waters.

"The shellfish producer must prove that what he's doing is benefiting the

public," Ellis says. "That's why there's a requirement for a certain amount of production on each lease."

Then there are poachers. Thieves. Ruthless people who prey on a shellfish lease when no one's looking.

"The law has been changed in recent years to protect shellfish aquaculture as a commercial enterprise and the

penalties for poaching are high," Ellis says. "But that still doesn't stop the thief."

And if that's not enough, environmental factors like pollution and disease can often ravage a shellfish operation. Most dreaded among oyster farmers are MSX and dermo, two killer diseases.

"It's hard to work an oyster bed, invest in all that time and money only to have it all destroyed by diseases," Ellis says.

When one considers the time it takes to get a shellfish lease (on the average about six to eight months), the monetary and time investment and the chance for poachers and disease, shellfish aquaculture doesn't sound like a viable enterprise.

"I wouldn't go that far," Ellis says. "Like I said, there's more demand than ever for clams and oysters. And, when you consider that the average price for a bushel of clams is about \$55, it looks a little more attractive."

And sometimes it works on a large scale.

Doug Brady, owner of Otis' Fish Market in Morehead City owns the state's largest shellfish production operation. His lease includes 10 acres of shellfish bottom.

He is the only shellfish culturist to

have taken advantage of a new law that allows leasing not only the bottom but the water column too.

Hundreds of thousands of clams and oysters are reaching market size on the Brady lease at Harker's Island.

But there's a cost factor involved in leasing the water column that most smalltimers can't afford.

In addition to the \$5 per acre fee for leasing the bottom, Brady pays another \$500 per acre for the right to use the water column.

For that money, he's allowed to grow oysters off the bottom in bags suspended in the water. He also has permission to fence in his lease, effectively protecting the site from poachers and recreational water users.

"It's expensive to do it that way," says Sea Grant marine advisory agent Skip Kemp. "But if you're a big time operator, you can do it."

Kemp says Brady's operation is the exception in the shellfish business. "I don't think there's going to be any spurt of large operations coming in," he says. "In fact, we're encouraging small-time operations."

Meanwhile, Kemp and others involved in shellfish culture are trying to persuade lawmakers to change legislation in favor of shellfish leaseholders, especially oyster growers.

"The law needs to change in how oyster culture methodology is defined," Kemp says. "Oysters grow better when they're kept off the bottom and grown in modular containers. Now, the law doesn't allow that unless a water column lease is obtained. And that can be expensive."

One state that has responded to the particular needs of oyster growers is Florida, where culturists are allowed to use up to 12 inches of the water column without acquiring an expensive lease.

A free water-column permit is available to Tar Heel shellfish growers only if the use of the water column is experimental and in small amounts. The permit does not allow commercial-sized ventures.

Meeting the Big Sweep Bunch

Big Sweep is back with a brand new bunch of friends to help tackle the problem of trash in our oceans, rivers and lakes. We call them "The Big Sweep Bunch."

Litter is not only ugly, it can be harmful or even deadly to living creatures.

When Sept. 21 rolls around, these five litter busters will be there with trash bags to help keep our shores safe for wildlife and

human life too! You can join them.

We've provided these finger puppets for you and your friends to play with. Just get a parent or a teacher to photocopy them on thick paper, enlarging them so that they're about 5 inches tall. Color them; carefully cut them out; and they're ready to go!

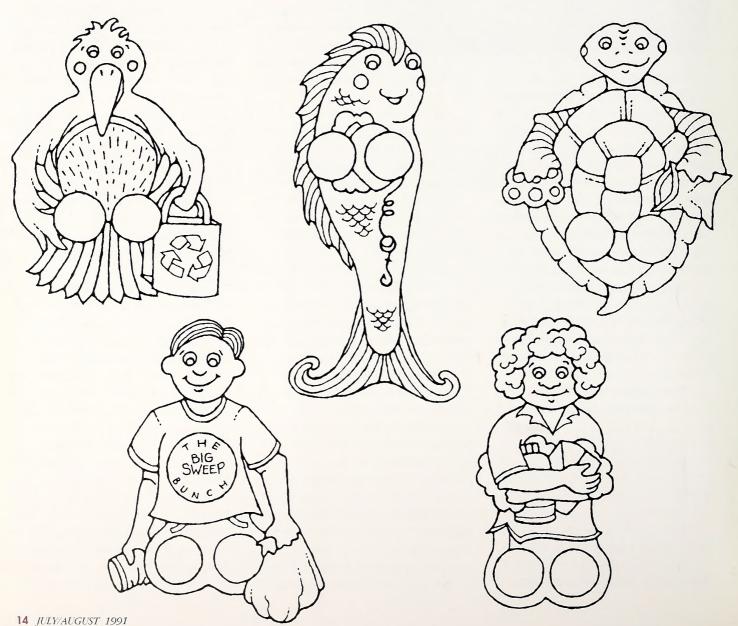
Our girl, boy, fish, turtle and bird haven't been named yet. Think of some

creative names for these heroes of the environment, and use them in your puppet shows. Write and tell us what you named them. We'd love to hear your ideas!

Our address is The Big Sweep, Box 8605, North Carolina State University, Raleigh, NC 27695.

Have fun!

Carla B. Burgess



Striped Bass: A Heritage of Good Taste

Twenty-five years ago, anglers could wade knee-deep in the Hatteras surf, cast a line just beyond the breakers and expect the tug-of-war it took to haul in a 40-pound striper.

Not anymore.

Stripers, more correctly known as striped bass, have suffered sharp declines in populations all along the East Coast during the last 20 years. The reason? Pollution, overfishing and loss of spawning habitat.

In fact, populations became so scarce that federal and state fishery resource managers along the Eastern Seaboard slapped a bevy of regulations, restrictions and moratoriums on the recreational and commercial capture of stripers.

Everyone was interested in rescuing the fish that meant so much to sportsmen, commercial fishermen and the history of this nation.

From his Jamestown settlement in Virginia, Captain John Smith made early note of the abundance and size of the striped bass he found in the rivers of the Chesapeake.

"The Basse is an excellent Fish, both fresh and salte," he wrote. "They are so large, the head will give a good eater a dinner, and for daintinesse of diet they excell the Marybones of Beefe. There are such multitudes that I have seene . . . so many as will loade a ship of 100 tonnes."

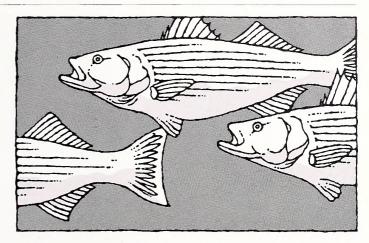
The Plymouth colonists also found the striped bass in ample supply and made them a regular part of their diet. In fact, they preferred the stripers to salmon.

The Massachusetts colony became so zealous in their consumption and use of striped bass as a fertilizer for farm crops that harvests diminished. In 1639, the Massachusetts Bay Colony ordered that neither striped bass nor cod could be used as fertilizer.

A subsequent act in 1670 declared that income derived from the Cape Cod striped bass, mackerel and herring fisheries be used to build a free school. This legislation resulted in the first public school in America. It was made possible largely through the sale of striped bass.

After the colonial period, striped bass were abundant along the East Coast. Prior to the Civil War, stripers became a fashionable sport fish, and after the war, associations of sportsmen dedicated to their capture were formed in New England.

Stripers are distributed along the Atlantic Coast from the St. Lawrence River in Canada to the St. Johns River in Florida. Biologists divide East Coast striped bass into nine populations,



which are associated with their spawning rivers. Two of the populations, Roanoke River/Albemarle Sound and Cape Fear, call North Carolina home.

Most striped bass are dark olive-green to dark gray along their backs, silvery along their sides and white on the belly. They have seven or eight dotted dark stripes along their sides.

Striped bass, like salmon, are anadromous. They move from the ocean up rivers to spawn in fresh water.

Spring is spawning season for stripers. They like to choose river areas where the water is fast-moving or turbulent.

One large female striped bass is surrounded by several smaller males. The bass begin thrashing the water in a courtship ritual fishermen call "rock fights." During the fight, the female releases 3 million to 4 million eggs that the males fertilize.

If not caught, striped bass can grow to be large. A sevenyear-old fish can weigh 20 pounds and measure 36 inches in length. By the time a striper reaches the age of 14, it can weigh 40 pounds and measure 40 to 42 inches in length.

The largest striper ever caught tipped the scales at 125 pounds. It was caught in Edenton in 1891. Biologists estimate that the fish measured at least 6 feet in length.

Although sportsmen love to haul in the big stripers, it's the smaller ones that make better table fare. Striped bass are best eaten when they weigh 6 to 8 pounds. As the fish grows heavier, its flesh becomes more coarse.

Today, because of catch restrictions, it's rare to see a striper grace the table. But fishery resource managers are hoping that fishery restrictions and hatcheries will once again boost populations of this popular fish.

Kathy Hart

Extending Knowledge to the Coastal Community

Encouraging Oyster Culture

As he drives past a mountain of wood chips at the Morehead City port, Skip Kemp's eyes brighten for a moment.

"Hey. Oysters like to settle on wood. If I could use wood chips for cultch material. . ."

He fishes a notebook from his hip pocket and writes, steadying the steering wheel with his other hand.

"If I don't write it down, I'll forget it," he says, laughing. "I must be getting old."

Ideas are a major part of Kemp's job. As a Sea Grant Marine Advisory Service agent, he's expected to help others come up with better ways to use coastal resources.

Recently, he assembled his years of practical and applied research into a manual on how to raise hard clams on leased estuarine bottom.

The manual, published by Sea Grant, is going like hotcakes.

These days, Kemp is concentrating on growing more and better oysters on that same estuarine lease.

"We've pretty much got clams down pat," he says. "Now, we want to grow more ovsters."

He pulls into the driveway at Charlie G. Brown's home near Harker's Island.

Brown walks with Kemp to the shallow sound bottom behind the house. The tide is low, and several clam and oyster beds are exposed to the morning sun.

He calls the Brown "farm" an ideal situation. "The water is right; the bottom is sandy. It's just that, until now, there was nothing for the oyster spat to settle on. Since we laid out this cultch material, this place will be productive for oysters."

He turns over a few cultch shells. Oysters are forming in clusters on some of them. The method seems to be working.



summer when oysters are spawning.
Contact DMF for facts on relaying oysters

working on it."

Here are a few of Kemp's tips on how you can raise oysters — for your own use or for sale — on leased estuarine bottom.

"We've got a long way to go to in

oyster culture," Kemp says. "But we keep

- Check the area to see if there are oysters already there. If there are a few, chances are the site will be good for oyster culture. Contact the N.C. Division of Marine Fisheries, and tell them of your intentions. They'll tell you if your site is closed because of pollution or disease. They'll also tell you if salinity levels are high enough for oysters.
- DMF will check your site for shellfish culture. If it's a natural shellfish bed containing 10 or more bushels per acre, they won't grant you a lease. Otherwise, they'll recommend that you apply for a lease. The non-refundable application fee is \$100, and it could take about six to eight months for approval. If approved, the lease fee is \$5 per acre per year, with renewal required every 10 years.
- When you have your lease, plant cultch material shells or marl to which small oysters can attach. Oyster shells are best for cultch. Put the cultch out in

• Monitor and manage your lease. "You can't just leave them out there without putting some work into the lease," Kemp says. Keep the cultch clean and free of silt and other material.

from polluted areas.

- Harvest your oysters in two to three years. "It's not a fast process by any means, and the grower should be patient," Kemp says. Oysters will grow faster if they are growing off the bottom, but that requires a water column lease, which is \$500 per acre per year.
- Sell your oysters to individuals or to restaurants if you have small amounts, or to seafood dealers if you have larger quantities. Dealers pay less. Do a little legwork, and find out when prices are higher. Leaseholders can sell when the season for natural harvest is closed, and they can also sell oysters smaller than the 3-inch size limit for natural oysters.

If you're interested in oyster culture, contact Kemp at his office in Atlantic Beach. His number is 919/247-4007.

C.R. Edgerton



Field Notes

Insights into Current Sea Grant Research

Secrets of Striper Spawning

They call it squeezin' season.

Every spring Sea Grant Associate Director Ron Hodson and North Carolina State University zoologist Craig Sullivan become midwives, directing the birth of thousands of hybrid striped bass fingerlings.

It all takes place at the Pamlico Aquaculture Center in Beaufort County.

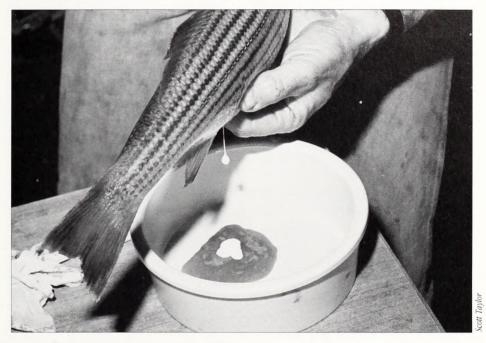
And it's all part of a program designed to control the life cycle of the striped bass. With that kind of control, broodstock — fish used for breeding purposes — can be domesticated. With domesticated broodstock, the infant hybrid striped bass industry could take off like a space shuttle.

But why "squeezin' season?"
Striped bass females and white bass males are caught in the wild during spawning season in North Carolina lakes and rivers and brought to the center.

There, they are injected with hormones that will increase the spawning urge and encourage the ripening of the female eggs. Males are injected with hormones to increase sperm production.

Then Hodson and Sullivan begin their watchful vigil. In about 36 hours, the fish are ready for the careful hands of the researchers.

When their eggs are ripe, the female fish are anesthetized and their lower bodies are squeezed. The eggs, resembling a frosty lemon-lime drink, are deposited into a metal tray. The sperm from the male fish is mixed with the eggs until Hodson and Sullivan are sure fertilization takes place. The fertilized eggs are then placed in cylindrical jars where they are held in suspension by circulating water, much like they would be in nature. In two days, the eggs hatch into "fry."



It's a complicated process that Hodson and Sullivan hope to make easier.

The best way to simplify it, they say, is to develop domesticated broodstocks and methods for spawning them on demand. Discovering this secret will give the hybrid striped bass industry the lift it needs.

"This is what we call 'closing the loop,' " says Hodson. "It means having complete control of the fish, from start to finish."

Unlike most other fish that are farmed, the striped bass presents some unusual problems in the creation of domesticated broodstock.

"Striped bass is considered more difficult to domesticate than white bass, and that's what we're concentrating on," he says. "The specific details of spawning have been totally unknown. We don't know what reproductive hormones control the process. Those kinds of things."

Hodson and Sullivan's research will

focus on three areas: developing reliable methods of reproducing broodstock on demand using injectable hormones; acquiring a basic working knowledge of maturation of striped bass; and using the new knowledge to shift the spawning season to desired times.

Gaining this much control of the life cycle of the striped bass would have a threefold advantage over current methods, Hodson says.

First, broodstock supplies would be guaranteed. Hatchery operators would have a reliable way of predicting spawning times and approximating the numbers of fingerlings that might be available.

Second, the impact of hybrid striped bass aquaculture on wild stocks of striped bass would diminish significantly.

And third, controlled spawning would open the door to year-round production of fingerlings and selective breeding of superior genetic strains.

C.R. Edgerton

The Aft Deck

A Bulletin Board of Updates and Events

First Citizens Bank Joins Cleanup

First Citizens Bank has been named the title sponsor for Big Sweep '91. The Sept. 21 cleanup will now be called the First Citizens Bank Big Sweep '91.

The bank will aid in the production of promotional materials that will encourage public participation. Its branches, which number more than 300 statewide, will serve as distribution points for Big Sweep brochures that will provide site locations and contacts.

In addition, First Citizens employees will be out in force on cleanup day to help clear litter from our state waterways.

"We're extremely pleased to have First Citizens Bank become part of The Big Sweep '91," says coordinator Lundie Spence, Sea Grant's marine education specialist. "We're happy that they are concerned about environmental issues, particularly the problem of litter in our state's waterways.

"By joining our cleanup effort, First Citizens is helping The Big Sweep make a commitment to the people of North Carolina to reduce waterway litter," Spence says. "That's a commitment to be proud of."

Stop by a branch of First Citizens Bank at the end of August to pick up a brochure. And take a moment to thank the branch manager or teller for helping to make The Big Sweep possible.

Other sponsors of this year's event or educational efforts include: ALCOA, R.J. Reynolds Tobacco Co., N.C. Wildlife Commission, N.C. Wildlife Federation, N.C. Beer Wholesalers Association, MCI and Texasgulf Inc.

The Big Sweep is coordinated by: UNC Sea Grant, N.C. Division of Coastal Management, N.C. Parks and Recreation, N.C. Division of Environmental Management, N.C. Division of Water Resources, N.C. Wildlife Commission, N.C. 4-H, Keep America Beautiful, Keep North Carolina Clean and Beautiful, Western North Carolina Development Association, WGHPiedmont 8, WRAL-TV, WSOC-TV, WLOS-TV, WWAY-TV and WITN-TV.



Big Sweep '91 Set for Sept. 21

The First Citizens Bank Big Sweep '91, the nation's largest statewide waterway litter cleanup, will be held Saturday, Sept. 21 from 9 a.m. to 1 p.m.

More than 18,000 volunteers are expected to turn out at approximately 200 sites across the state to remove debris from our shorelines — lakes, rivers, creeks, estuaries and beaches.

We want to rid our waterways of litter because it can be harmful to people and wildlife. Every year, birds become entangled in abandoned fishing line and die; turtles strangle after eating discarded plastic bags; and fish become ensnared in six-pack yokes.

On Big Sweep day, volunteers collect two things: litter and data. As they bag their trash, they record their finds on data cards. The collection of this data is an important part of Big Sweep because it helps organizers pinpoint the types and sources of North Carolina's waterway litter.

If you want to volunteer on Sept. 21, stop by your local First Citizens Bank branch at the end of August and pick up a brochure with the cleanup sites. Or phone The Big Sweep MCI hotline at 1-800-27-SWEEP after Aug. 1. Volunteer operators will be standing by to direct you to cleanup sites in your area.

If you know of a waterway that needs a thorough cleaning, contact Big Sweep headquarters at the Sea Grant office in Raleigh at 919/515-2454. We'll direct you to a regional coordinator in your area.

If you have other questions about the cleanup or would like to support the cause by purchasing a T-shirt, contact us at 919/515-2454.

We hope you'll be a part of the First Citizens Bank Big Sweep '91. It's good, clean fun.

"Don't Leave Your Butt on the Beach"

Cigarette butts were the most prevalent item bagged on beaches during fall 1990 cleanups along the shores of 26 states and three U.S. territories. Volunteers collected 531,828 butts, or the equivalent of 26,591 packs of cigarettes.

Although many smokers are obviously using our nation's beaches as ashtrays, Lundie Spence says the use is probably unintentional. Spence is coordinator for the First Citizens Bank Big Sweep '91 and Sea Grant's marine education specialist.

"Many people think filters are paper and will easily degrade," says Spence. "They flick the butts aside without a second thought."

But the truth of the matter is that most cigarette filters are made of cellulose acetate, a synthetic material that is classified as plastic. And plastic lasts for decades.

"We feel smokers just need to be

educated about the problem," Spence says. And R.J. Reynolds Tobacco Co., one of the world's largest manufacturers of cigarettes, agrees.

R.J. Reynolds is joining the First Citizens Bank Big Sweep '91 with a "Don't Leave Your Butt On the Beach" campaign that the company is launching at 30 selected beaches across the nation. Wrightsville Beach is one of the designated beaches.

They will be using billboards and tentcards in local businesses to display their cleanup message.

"We're happy that R.J. Reynolds is joining us." Spence says. "It's nice to see a company such as RJR work with their consumers to make them aware of our litter problem. It's such a positive, proactive stance."

How to Stay Tuned to Big Sweep '91

If you want the latest news about the First Citizens Bank Big Sweep '91, tune in to one of the television stations helping to coordinate this event.

In Greensboro/High Point/Winston-Salem, turn to WGHPiedmont 8 for news, features and updates about the Sept. 21 cleanup. In the Triangle, watch WRAL; in Wilmington, WWAY; and in the northeast, WITN. For mountain viewing, catch the evening news on WLOS, and in Charlotte. WSOC is the station to watch.

This year will be second year most of these television stations have helped to bring more information about The Big Sweep to North Carolina citizens.

"Each station has made a commitment to help their viewers become more environmentally aware," says Kathy Hart, Big Sweep publicity coordinator and Coastwatch editor. "The stations have helped us make so many more people aware of this cleanup. Their involvement has been invaluable."

Seafood and the Environment **Symposium**

Sea Grant's seafood extension

specialist David Green has organized a multi-faceted Seafood and the Environment Symposium to be held in Raleigh Sept. 29 through Oct. 3.

The four-day symposium will kick off with a reception Sunday night. The Tropical and Subtropical Fisheries Technology Conference will meet from Monday through noon on Tuesday. Attendees will exchange information about the latest developments in seafood technology from production to utilization.

Tuesday afternoon, participants will receive a short course on water quality, pollution prevention and regulations on seafood residues/wastes. Tuesday night, exhibitors will be on hand to display the latest in food processing equipment and ingredient supplies.

Wednesday, the focus shifts to pollution prevention in the seafood industry as the 1991 Seafood Environmental Summit begins. The summit will focus on water quality and waste reduction in the seafood processing industry.

Fishermen, seafood dealers, processors, government personnel and researchers should attend. The registration fee is \$160.

For more information about the conference, contact David Green at the NCSU Seafood Laboratory in Morehead City at 919/726-0254.

Sea Grant Publications Are Winners

S.E.A. LAB: Science Experiments and Activities is a winner. Judges for the Society of Technical Communication's International Publication Competition presented an Award of Merit to Sea Grant for its high school curriculum guide for science teachers.

The award was based on the writing, editing and design of the 200-page book. S.E.A. Lab also won a Distinguished Technical Communication award from the Carolina Chapter of the STC. This award qualified the book for the international competition.

Coastwatch also won a Carolina Chapter Award of Excellence.



Big Sweep Lauded as **Environmental Success**

The Big Sweep continues to bolster its national reputation as a significant environmental event.

The nation's first statewide waterway litter cleanup has been accepted for listing in the 1991 Environmental Success Index, a unique clearinghouse of environmental information made available to key public and private decision makers.

Being part of the ESI means that Big Sweep will be promoted as a model program.

Tina Hobson, spokesman for the ESI, says Big Sweep's application was subjected to "a rigorous verification process" before being chosen for listing.

Now policymakers, politicians, citizens' groups, and public and private organizations will be able to apply the knowledge gained by Big Sweep volunteers to their own litter cleanup campaigns.

And there's more.

The Big Sweep has again won the prestigious Take Pride in America national award.

For the fourth straight year, The Big Sweep has been recognized with one of the nation's top environmental kudos.

The award was presented in Washington, D.C. on July 22.

"Of course, we're very proud of what The Big Sweep has accomplished over the years," says Lundie Spence, Sea Grant's marine education specialist and coordinator of the annual waterway cleanup. "And we're always striving to do more to make our environment cleaner and safer."

Coastwatch wants to hear from you on topics relating to the North Carolina coast. Letters should be no longer than 250 words and should contain the author's name, address and telephone number. Letters may be edited for style. Send all correspondence to Coastwatch, UNC Sea Grant, Box 8605, North Carolina State University, Raleigh, NC 27695. Opinions expressed on this page are not necessarily those of UNC Sea Grant employees or staff.

A Future Surf Fisherman?

Dear Editor.

I have been a *Coastwatch* subscriber for so many years I can't remember. This is an excellent publication, and I will be pleased to continue under the paid magazine concept.

However, I'm writing you for another purpose. We have been vacationing on the Outer Banks, specifically Ocracoke, for the last 15 years. This year I would like to take up surf fishing. This is where I hope you can help me.

I know nothing about surf fishing. What equipment do I purchase? What fish do you catch? Where and how do you catch them? And last, but not least, when you catch a fish how do you know what you caught and if you can eat it?

Could you please send me information about the above, or point me in the right direction to get this data.

A surf fisherman to be.

Robert C. Ashman, Muncy, Penn.

The best place to learn about surf fishing is in the surf. Fishing is a fine art, one that can't be taught entirely from books.

You need to talk to the experts, those men and women who spend a good portion of their time and effort practicing the art. Ask them. They'll tell you what kind of equipment you'll need and what type of bait to use. They'll show you how to cast a line, tie a leader, cut a shrimp, slice a squid.

But don't be surprised if they refuse to show you their favorite fishing holes. No fisherman is expected to go that far.

Sea Grant can help you in one area, though. If you're not sure whether the fish you've caught is edible, send for our publication "Recipes With a New Catch." Our series of brochures on underutilized species can help also. The recipe book is \$2. Ask for publication number UNC-SG-86-06. The brochures are \$2 for the two sets. Ask for publication numbers UNC-SG-85-09 through 85-18 and UNC-SG-86-13 through 86-18.

Finally, you might want to contact the folks at North Carolina State University who sponsor the annual Sport Fishing School.

There are two sessions each year. For information, contact Mac Currin, Box 7617, NCSU, Raleigh, NC 27695-7617.

A Few Encouraging Words

Dear Editor.

Enclosed is my check in the amount of \$12 for a subscription to the "new" *Coastwatch*. The format sounds great and I wish you every success.

Thank you for the "old" *Coastwatch*. It has been most interesting and educational.

Neil A. McNeil, Fayetteville, N.C.

Concerned About Oyster Clusters

Dear Editor,

I would like to see an article on digging clams and gathering oysters. I am always concerned about where it is safe (i.e. non-polluted) and not damaging young clams and oysters. I hear people say they get clusters of oysters. It seems to me that the mature oysters should be broken away from the young ones on the cluster with the young oysters and the cluster thrown back to grow.

I have enclosed my check for the subscription. I think *Coastwatch* will be a successful magazine if you can show people how to use coastal resources in such a way that we can preserve and grow rather than destroy.

Keep up the good work.

Elisabeth Mikulewicz, Wilmington, N.C.

Harvesting oysters and other shellfish in polluted waters is prohibited by law. These waters are usually clearly marked by warning signs erected by the state's Division of Marine Fisheries. The division monitors the waters to make sure illegal harvesting is not taking place.

Often, the division will allow relay of clams and oysters from polluted to non-polluted waters. These shellfish can be harvested and sold only after they purge themselves of pollutants (24 to 48 hours).

Oysters do grow in clusters and, unfortunately, some people barvest them without regard to size. North Carolina law forbids the barvesting of oysters less than three inches long. If someone finds a cluster of mixed sizes, the smaller ones must be broken off where feasible and returned to the water.

For more information concerning fish and shellfish regulations, contact the N.C. Division of Marine Fisheries in Morehead City at 919/726-7021.

The

Book Store

Publications to Enrich Your Coastal Library

It's time for teachers to start thinking about new rosters of students and lesson plans. As you plan for the school days ahead, why not add a little marine science to your classroom curriculum? Sea Grant has a wealth of marine science curriculum guides for teachers from kindergarten through high school.

ELEMENTARY EDUCATION

There's no better way to learn than by doing.

And that's the concept behind Sea Grant's Coastal Capers: A Marine Education Primer. This booklet offers 20 hands-on activities that teach grade-schoolers about the coast.

For instance, children learn how to weave a marine food web and how to clean up an oil spill of their own making. By designing their own aquatic creatures, children learn how fish adapt to their environment.

The activities sharpen student skills in science, mathematics, language arts, social studies and art.

For a copy of Coastal Capers, write Sea Grant. Ask for UNC-SG-84-05. The cost is \$3.50.

AN EARLY **EDUCATION ABOUT LITTER**

Many of our adult patterns and habits are set in childhood.

That's why The Big Sweep, North Carolina's statewide waterway litter cleanup, began its educational effort with grade-schoolers.

Ripples: A Big Sweep Elementary Activity Guide is a collection of 16 activities that teach children about the effects of litter in our aquatic and marine environment.

Children can solve a litter crossword puzzle, simulate animal entanglement with a rubber band or learn how to turn their trash into treasure.

The activities are designed for 9- to 11-year-olds. But some of the ideas can be modified for younger or older children.

Ripples is ideal for use in the classroom, Scout meetings, 4-H gatherings or church school — anywhere children can be taught stewardship of our aquatic resources.

For a copy of this Big Sweep guide, write Sea Grant. Ask for UNC-SG-90-02. The publication is free, but please enclose \$1 to cover postage.

MANUALS FOR MIDDLE SCHOOL

For middle school science and social studies educators, Sea Grant offers four marine education manuals designed to bring the coast to the classroom.

Each manual has a similar format. Activities and laboratory exercises provide students with hands-on experience.

Additional resources, films and references are listed.

* Unit One, Coastal Geology (UNC-SG-78-14A) focuses on plate tectonics, development of North Carolina's coastal plain, and the wind and water movements that shape the barrier islands and sounds.

* Unit Two, Seawater (UNC-SG-78-14B) concentrates on tides, waves, ocean chemistry and seawater biology.

* Unit Three, Coastal Ecology (UNC-SG-78-14C) provides an introduction to marine organisms in North Carolina — where they live, the adaptations that allow them to live in these areas and the interrelationships of marine organisms and their habitats.

* Unit Four, Coastal Beginnings (UNC-SG-78-14E) centers on the past cultures of coastal people. It explores anthropological techniques used to study old cultures, Indian culture prior to 1585, early explorations of North Carolina and patterns of colonial settlement.

All of the manuals are available from Sea Grant. Please specify which you are ordering. Unit One costs \$3.50. The other units are \$2 each.

HIGH SCHOOL **EXPERIMENTS**

From designing a dichotomous key for seashells to learning about salinity stratification in the estuary.

understanding marine concepts can be an exciting part of high school science.

Sea Grant has a manual, S.E.A. Lab, designed to help high school chemistry, biology and physics teachers add marine science concepts to their curriculums.

The 200-plus page book includes 60 activities that will help students learn about the physics of waves, the biological clocks of ocean creatures and the behavior of gases in the marine environment. And there's lots more.

For a copy of this illustrated manual, write Sea Grant. Ask for publication UNC-SG-90-01. The cost is \$12.

When ordering Sea Grant publications, please include your mailing label from Coastwatch or the customer identification number that appears above your name. This will speed delivery. Also be sure checks are made payable to Sea Grant unless otherwise specified.

Send all publication requests to: Publications, Sea Grant Box 8605, North Carolina State University, Raleigh, NC 27695. If you wish to order multiple copies or need further assistance, contact Carole Purser, publication distribution manager, at 919/ 515-2454.



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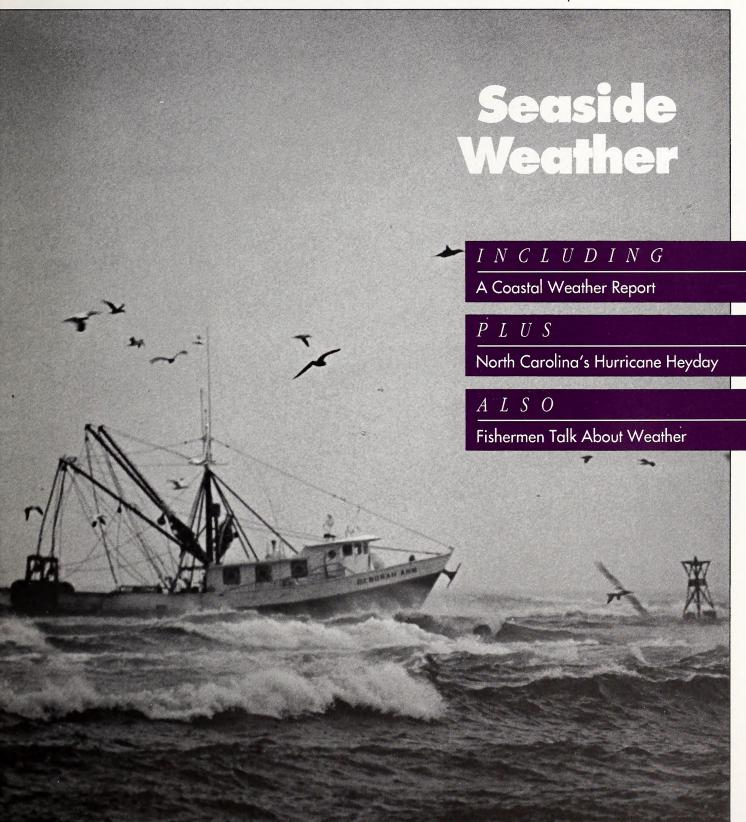
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UNC Sea Grant September/October 1991



Coastwatch

Coastwatch Staff:

Kathy Hart, *Managing Editor*C.R. Edgerton and Carla B. Burgess, *Staff Writers and Editors*L. Noble, *Designer*Julie Snyder and Debra Lynch, *Circulation Managers*

The University of North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, UNC Sea Grant supports several research projects, an 11-member extension program and three communicators. B.J. Copeland is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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RALEIGH

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See you next issue, Kathy Hart

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Coastwatch

Box 8605

UNC Sea Grant College Program

North Carolina State University Raleigh, NC 27695-8605

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From The Top

OCT 14 1991

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Dear Readers:

Welcome to the world of weather. This month, Coastwatch concentrates on the weather patterns and events that have, on occasion, literally shaped the North Carolina coastline.

In our first story, I'll tell you why the weather makes for more than just passing conversation along the Tar Heel coast. Waterspouts, northeasters and hurricanes can threaten the lives and property of those who live, work and play along our shoreline.

Then C.R. Edgerton will look back to the 1950s, when six hurricanes came to call on North Carolina within 13 months. These ladies, the most notorious of whom was called Hazel, wreaked havoc in coastal counties.

What effect does the weather have on recreational and commercial fishing? Carla Burgess got the scoop on the topic of weather and fishing from the experts themselves. And in talking to longtime coastal residents, Burgess got an earful of colorful weather sayings to pass along to you.

We hope you enjoy this issue.

See you next issue, Kathy Hart

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Winds, Rains and

By Kathy Hart

Put two people together anytime, anywhere and the conversation will always turn to the weather.

"Hot enough for ya?"

"Say, that was some storm we had last night."

For landlubbers, weather talk is just a way to make idle conversation. Only on rare occasions does it affect their lives or their property.

But it's a different story along the coast.

Along this edge between the land and sea, the weather can take on an ominous, more life-threatening significance.

From June until November, the threat of hurricanes hangs over the heads of coastal folks like the impending dread of bad news. And as soon as the door is closed on hurricane season, it's time for nor'easters to come calling.

These active and sometimes violent coastal weather patterns are enough to keep forecasters hopping.

Summer Thunderstorms and Waterspouts

In the summer, the coast is subjected to what Al Hinn calls the "sea breeze effect." Hinn is a meteorologist at the



A waterspout.



National Weather Service's Wilmington office, and he's had 16 years experience forecasting coastal North Carolina weather.

During summer, the warm, moistureladen sea breeze blows westerly from the ocean toward inland counties. About midday, the moisture starts to form swelling clouds over coastal counties.

By afternoon, the breeze has picked up speed, adding increasing amounts of moisture to the building clouds, which heighten to thunderstorm proportions. By evening, they often begin their march to

Those caught in their paths may ex-

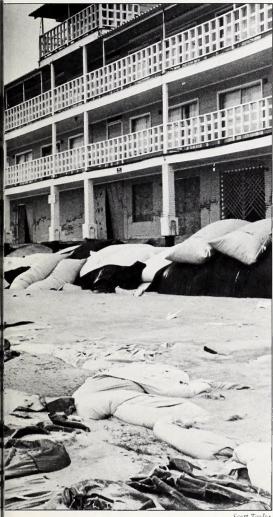
perience thunder, lightning, heavy downpours and an occasional tornado. As a result of the mid-summer heat and humidity and the sea breeze effect, July is usually the wettest month of the year for these coastal counties.

During the night, the thunderstorms move offshore only to regenerate over the Gulf Stream. Hinn warns that evening hours nearshore and daybreak near the Gulf Stream are often dangerous times for offshore boaters and fishermen.

Occasionally the storms formed by the sea breeze effect or those associated with a passing cold front spawn water-

Along this edge between the land and sea, the weather can

Hurricanes



spouts, or tornadoes over water.

Waterspouts come in two types: those associated with severe thunderstorms and those that form in very instable atmospheric conditions in the fall.

Severe thunderstorm spouts often start over land as true tornadoes and then move over water. They come complete with sinister, snake-like funnels, enormous overhead clouds and a frenzied roar of rapidly rotating winds. Sometimes they whirl across the ocean's surface for more than an hour.

The cold-air spout forms only over water, developing as spiraling funnels from low clouds near the sea surface or from showers. They are usually small and last from two to 20 minutes.

Hinn says that waterspouts are most prevalent along the Tar Heel coast in the fall when very warm water temperatures contrast with cool air temperatures. The warm air rising off the water and the cool air descending from above can be set into a circular motion by the earth's rotation.

Waterspouts can be dangerous, Hinn says. Any boat caught in the twisting funnel can be torn apart by strong and shifting winds. If boaters spot a waterspout, they should determine its direction, Hinn says, and then move at right angles away from the whirling funnel.

Northeasters

From late winter until early spring, coastal residents anticipate the arrival of northeasters with the same dread they feel for the arrival of their least favorite relative.

Like the unwanted guest, these winter storms come on strong, stay too long and leave destruction in their wake.

Northeasters are counterclockwise rotating low-pressure systems that travel northward along the Atlantic Seaboard. They are frequently laden with battering winds, driving rain or snow, and lashing waves that can lick up vast quantities of beach sand.

Northeasters are notorious for hurling their erosive forces at the North Carolina coast. In fact, in recent years these storms have been more destructive and costly for our coastline than hurricanes.

Besides their winds and waves, northeasters also possess an enduring quality. These winter storms can park off the coast for days, battering the shoreline on high tide after high tide, says Spencer Rogers, Sea Grant's coastal engineer.

And where these storms do the most damage depends on the orientation of the shoreline and the position of the storm.

The famous Ash Wednesday northeaster of the 1960s terrorized communities along the Outer Banks. But the New Year's Eve northeaster of 1987 wreaked havoc along the southeastern shore.

Three types of northeasters travel North Carolina's offshore waters.

The first type moves from the Gulf of Mexico to the South Atlantic, typically close to Cape Hatteras. There, the storm draws strength from the warm waters of the Gulf Stream before hurling northward.

These systems are called Hatteras lows, and in the 1980s, a team of scientists assembled in North Carolina to study the formation of these famous storms.

Researchers from North Carolina State University's Department of Marine, Earth and Atmospheric Science played a major role in the study. And now their research is paying off in the design of models that will help forecasters predict the notorious winter troublemakers (see Field Notes, page 17).

Another type of northeaster forms when a strong low pressure system in the Great Lakes or the Ohio Valley transfers its energy to a developing low-pressure system along the Mid-Atlantic coast.

The third variety of these winter storms derives from a rare alignment of weather systems. A strong high-pressure system in the Northeast combines with low pressure in the Southeast to make for strong northeast winds, building waves, rough seas and higher high tides.

Northeaster activity along the Tar Heel coast varies and depends on the presence of an upper level trough of low pressure over the Southeast and the position of the polar and subtropical jet streams.

Hurricanes

From Currituck to Calabash, coastal populations are burgeoning. Most of the newcomers are true-blue landlubbers who never hung a gill net, cleaned a crab or experienced a hurricane.

Continued on the next page

They don't know what it's like to look a Hazel or a Hugo in the eye; what it's like to be lashed by winds of 120 mph, battered by waves more than 15 feet tall or inundated by a storm tide that exceeds 12 feet; or what it's like to drive away from a home of possessions and memories knowing they might not be there tomorrow.

But this lack of experience with hurricanes isn't limited to North Carolina. All along the East and Gulf coasts, officials with the National Weather Service are working to educate the growing number of transplanted inlanders about the hazards of hurricanes.

In North Carolina, it isn't just new seaside residents who need an education. Many long-time coastal dwellers don't have much knowledge of these ferocious storms either.

Since the 1950s when Hazel and her sisters came calling (see story, page 6), hurricanes have shied away from the Tar Heel coast. During the last decade, Diana played tag with the southern coast in 1984, Gloria brushed by the Outer Banks in 1985, Hugo spread its fringe effects into Brunswick County in 1989 and Bob skirted by Cape Hatteras in 1991.

But Bob, Gloria and Diana certainly weren't in the same class of hurricanes as Hugo, Hazel and Camille. These catastrophic storms are among the 12 most costly and deadly storms of the century.

Hugo and Hazel were what the weather service classifies as Category 4 storms. Their winds ranged from 131 to 155 mph, and their storm tides, or surges, reached 13 to 18 feet.

Camille, which came ashore along the Gulf Coast in 1969, was one of only two Category 5 hurricanes to strike the United States this century. Her winds exceeded 155 mph, and the storm surge measured more than 19 feet.

If a storm of Camille's magnitude struck the Tar Heel coast, the majority of the barrier islands would be under several feet of water, says Rogers.

But luckily, storms that size don't occur often. During an average year, 12 tropical disturbances become tropical storms and receive the dubious distinction of receiving a name. Four of these storms will become hurricanes, and one of the four will become a Category 3 or higher storm, Hinn says.

Oddly enough, weather patterns in Africa may play a key role in affecting hurricane activity in the United States.

If rainfall amounts are above normal in Africa, then weather patterns favor the formation of tropical waves across the con-

Take Hugo for example. It struck the South Carolina coast head-on. And that means the storm's strongest sector, the right front quadrant, slammed ashore from Folly Beach to Brunswick County. Not surprisingly, these were the areas that sustained the most damage.

Hinn says the right front sector tends to be most severe because the energy from both the hurricane's forward and ro-



NOAA airplanes fly into the eye of a hurricane.

tinent. These waves become imbedded in the westward-blowing tradewinds and, under certain conditions, intensify to become hurricanes in their trek between Africa and the Caribbean, Hinn says.

"By and large, most of the hurricanes that have struck North Carolina developed between the Leeward Islands and the Bahamas," Hinn says. "The exceptions were Hazel in 1954 and Donna in 1960."

Hinn adds that the Outer Banks are the most likely target for these tropical cyclones. Including Bob, 23 hurricanes have left their mark on the Outer Banks this century, but only nine have tangled with counties south of Carteret.

Hinn attributes the difference to the shape of the North Carolina coast. Because Cape Hatteras juts eastward into the Atlantic, it's more likely to be clipped by these northbound freight trains of atmospheric

Although close calls by hurricanes such as Bob and Gloria are not to be scoffed at, they're nothing like a direct hit from a storm traveling perpendicular to the coastline, Hinn says.

tating motion are concentrated there. In contrast, the left front sector poses the least threat. The wind direction in this area is mostly offshore. That's why Bob's passage east, instead of west, of the Outer Banks meant good news.

A tropical storm becomes a hurricane when its maximum sustained winds exceed 74 mph. The winds blow in a counterclockwise spiral around a calm center — the eye of the hurricane.

The winds within this whirlwind spiral at a faster and faster rate as they near the hurricane's center of low pressure. The fastest winds, those within the wall cloud surrounding the eye, can easily gust to more than 200 mph.

Although a hurricane's winds are a force to be reckoned with, they are one of the least destructive aspects of these cyclones. It's the storm surge that causes the most damage to structures and nine out of the 10 deaths associated with hurricanes.

The storm surge is the rise in water level that occurs as the hurricane moves ashore. It does not include the waves that ride atop it.

If a storm of Camille's magnitude struck the Tar Heel coast, the majority of the



Arrows show where hurricanes have made landfall in the last 105 years.

This dome of water, which can exceed 15 feet, can submerge low-lying tidal areas. It can undermine houses by scouring away sand. And it can pull at walls, pilings and foundations, causing them to collapse.

Riding atop this surge are hurricane waves that can reach 15 feet in height.

But that's only half of it.

Water weighs about 1,700 pounds per cubic yard. Throw that weight against a building over and over, and you have a nature-made hammer that can demolish any structure not specifically designed to withstand such force.

And there's more.

Hurricanes can drop six or more inches of rain in a matter of hours over the areas they pass. The resulting floods can cause major property damage and loss of life even to inland areas miles from where the hurricane made landfall.

Diana, a rather mild Category 2 hurricane, pelted Wilmington with 15 1/2 inches of rain over three days in 1984, Hinn says. The one-two punch of heavy rains and strong winds uprooted trees that fell on houses, cars and other valuable possessions. By the time agricultural damage was added to property losses, Diana ran up bill of more than \$70 million.

With so much to lose in property and life, it's easy to see why the weather service's National Hurricane Center in Miami has developed sophisticated equipment to track these killer storms.

The day has passed when a hurricane could develop and go unreported until it slammed ashore. Satellites, weather reconnaissance planes and radars track hurricanes from their conception to their landfall to their final dying gasp.

By using all the means at its disposal, the weather service attempts to predict the path of these erratic tropical cyclones and adequately warn coastal communities of impending danger.

Forecasters issue a hurricane watch when a storm may threaten an area within 36 hours. The area under the watch may be extensive since the location of the hurricane's landfall is uncertain. Residents in these areas should take preparatory action and stay abreast of the

storm's progress.

A hurricane warning is issued when the cyclone is expected to strike within 24 hours. The area under a warning is smaller because forecasters can now narrow the possible location for landfall.

When warnings are posted, residents and visitors along the beachfront, in lowlying areas or in mobile homes should leave. If local and state officials ask for evacuation, everyone should go.

The weather warning system works. The death toll in the United States from hurricanes has decreased as the weather service's warning ability has improved.

But hurricane forecasters are worried that the time schedule for warnings and watches may not be enough to safely evacuate an ever-increasing population of coastal residents over bridges, roads and highways not designed to meet evacuation demands.

The alternative of offering greater lead times for evacuation is equally wrought with problems.

Long-range forecasting for the landfall of these great storms is still uncertain, despite improvements in technology. To give more time for evacuation would mean that hurricane warnings would have to apply to larger chunks of coastline — much of which may never feel the effects of the storm.

And forecasters know that the public will not continually evacuate when, in fact, no storm comes ashore.

That's not to mention the costs of hurricane preparation. Officials with the weather service estimate that advance preparation — boarding up homes, closing down businesses, losing sales and sending tourists home — can cost a coastal community millions of dollars.

With sums like that, coastal communities can't afford to prepare often.

So to avoid being compared to the boy who "cried wolf," the weather service is standing by its present system of hurricane watches and warnings. But they're striving harder to educate the public about the dangers these great storms pose.

And the education won't be a minute too late. Increased development and population growth have made the coastal sections of the United States more vulnerable to hurricanes than ever before.

barrier islands would be under several feet of water...

The Year

By C.R. Edgerton

Milton Berle was making us laugh. Timmy and Lassie were making us cry.

And Carol, Edna, Hazel, Connie, Diane and Ione were destroying our coastline.

In the 13 months between Aug. 30, 1954 and Sept. 19, 1955, these six hurricanes struck on or near the North Carolina coast, leaving death and destruction in their wakes.

Never before or since has such a rapid succession of hurricanes hammered Tar Heel shores.

Merchants boarded windows, ripped the boards off, and boarded them again and again. Fishermen tied their boats down, loosened them and repeated the process. Tourists wondered if their vacation would be the next to be ruined by a storm from the sea.

Lifelong coastal residents had weathered many storms, but had never seen anything like this. They began to

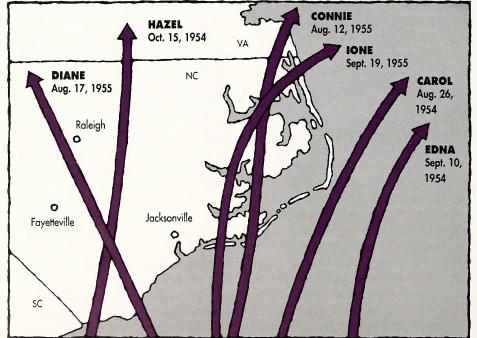
wonder just how long this pelting of their property would continue.

Nearly 40 years later, most of the six hurricanes have long been forgotten. At least one of them — the powerful Hazel — lives on in the memories of thousands of people who witnessed the most severe hurricane ever to punch the breath out of The Old North State.

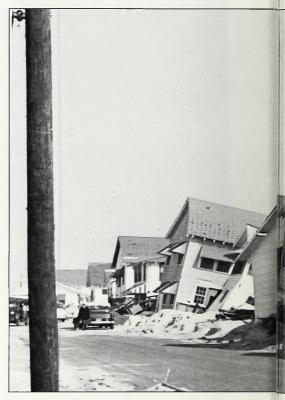
There are theories — some credible. some based on pure conjecture. But most scientists will tell you that they aren't sure why such a large number of hurricanes made landfall in such a small area and in such a limited amount of time.

"Five years ago, I would have told you that this is all random, that hurricanes don't really have a pattern to them," says Joe Pelissier, deputy director of the National Weather Service office at Raleigh-Durham International Airport.

"But now, with all we know about hurricane data, I might say that hurricanes can be predicted to a certain degree," Pelissier says, adding that there are



The paths of the hurricanes of 1954 - 1955.



What Hazel left behind...

hurricane patterns that might be related to other meteorological events.

He points to the work of William Gray, a professor at Colorado State University. Over the last six years, Gray has developed statistical models based on certain weather-related events - the Pacific El Niño water-warming phenomenon, the amount of rainfall in Western Africa, biennial east-west winds above the equator and lowering of air pressure along with increased upper-atmospheric winds in the Caribbean Sea.

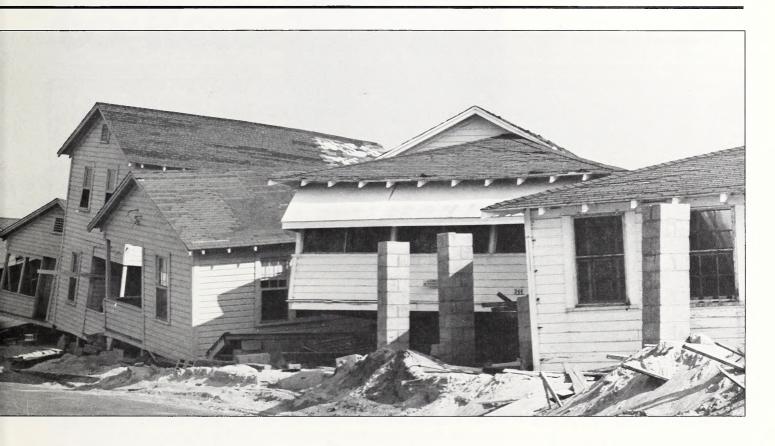
All these phenomena affect when and where hurricanes occur and the power they contain, Pelissier says.

"Some think it's a statistical fluke, but the evidence is convincing," he says.

A coupling of the data associated with the hurricanes of 1954-55 in North Carolina with the other weather phenomena in

In the 13 months between Aug. 30, 1954 and Sept. 19, 1955, these six hurricanes struck

of the Hurricanes



Gray's prediction model might reveal clues to why six hurricanes slammed into North Carolina in 13 months.

"But people should remember, in meteorology ... you're rarely going to get anything that's exact," Pelissier says.

Here's a rundown of the six storms and the damage they caused:

Carol — Hurricane Carol formed in the Bahamas on Aug. 26, 1954 and brushed North Carolina just east of Cape Hatteras about 10 p.m. Aug. 30. Because the beaches were on the west side of the storm's counterclockwise winds, damage was not severe. Some crops were destroyed, and some houses and fishing piers were damaged.

At Cape Hatteras, where winds were measured at 90 to 100 mph, about 1,000 feet of highway was undermined. Folks along the Outer Banks cringed with

empathy when they learned the next day that Carol had made landfall in the New England states, causing costly destruction and killing 60 people.

Edna — Only 15 days after the brush with Carol, Outer Bankers were told that yet another hurricane, this one named Edna, was traveling their way. Residents braced themselves again, but again they were spared as the great storm passed about 60 miles east of Cape Hatteras in the Atlantic. On Sept. 10, winds of about 70 mph were recorded at Cape Hatteras. Some crops were damaged, some piers were slapped, and a little more of the Outer Banks highway washed out. Again, New Englanders bore the major brunt of this hurricane.

Hazel — On Oct. 15, 1954, a storm unlike any other struck the North Carolina coast with a ferocity not seen before or

since. Her name was Hazel, and even to mention her sends chills down the spines of those who survived her wrath.

The Caribbean Sea gave birth to Hazel in early October. In her 13-day life, she caused widespread damage from Haiti to Canada. In North Carolina, she created \$100 million in damage (think what that would be in 1991 dollars), killed 19 people and injured 200 others. At least 30 Tar Heel counties reported damage to buildings.

Hazel struck the North Carolina coast near Shallotte around 10 p.m. on the 15th with sustained winds as high as 150 mph.

The following is excerpted from a report written last year by James D. Stevenson of the National Weather Service in Wilmington: "Wind-driven tides

Continued on the next page

on or near the North Carolina coast, leaving death and destruction in their wakes...

devastated the immediate oceanfront from the South Carolina line to Cape Lookout. All traces of civilization on that portion of the immediate waterfront between the state line and Cape Fear were practically annihilated."

Stevenson says the dune line, which in some cases was 20 feet tall, was washed away. So were the houses and cottages that had been built behind the dunes for protection.

In Long Beach, 352 of the town's 357 buildings were "washed into the sea." This story was repeated up the coast at Holden Beach, Carolina Beach and Wrightsville.

But the winds weren't the only problem. Storm surges and tides as high as 14 feet above normal were common. At the Holden Beach bridge, water measured a whopping 18 feet above normal. The Cape Fear River at Wilmington reached its highest point on record. That town suffered major damage and was without electricity for three days.

Hazel's destruction was not limited to coastal areas. After striking the shore, she bullied her way through North Carolina's heartland, destroying crops, homes, barns and buildings.

At Raleigh, she uprooted trees and caused thousands of dollars in damage. As far inland as Smithfield her winds were recorded at 90 to 100 mph.

After cutting a path into Virginia, she continued northward, pouring torrential rains in several states and flooding two Canadian provinces. She was last detected over Scandinavia where she finally fizzled.

Experts have called Hazel a freak, but other folks have labeled her a judgment from a higher power. She was a severe hurricane that jumped ashore in North Carolina on the exact date of the highest tide of the year — the full moon tide of October.

Locals call this the marsh hen tide because salt water rises in the marsh grasses, floating marsh birds above their protective cover and making them easy targets for hunters.

Connie — After several days of sloppy, sluggish movements in the Atlantic Ocean, Hurricane Connie slammed into



Will it happen again? Will Tar Heel residents face a similar onslaught of hurricanes in the future?

the North Carolina coast on the morning of Aug. 12, 1955. Connie probably will be best remembered for the amount of water she dumped onto Tar Heel farmlands. Thousands of acres were flooded.

Because she was slow-moving, this storm caused pounding waves to eat away at the Carolina coastline from Southport to Nags Head. Beach erosion was estimated worse than that caused by Hazel 10 months earlier. The towns of Oriental, Belhaven, Plymouth and Elizabeth City received the brunt of Connie's winds and rains.

Diane — Coastal residents were in the process of estimating the cost of Connie when they heard the horrible news over radio: yet another hurricane, the fifth in 12 months, was churning in the Atlantic on a beeline to the North Carolina coast. Her name was Diane, and she was expected to strike land in the early morning hours of Aug. 17.

Diane made her appointment at Carolina Beach on schedule, bringing with her winds measuring 74 mph. Like her sister of a week earlier. Diane ferried walls of salt water inland, eating away at beaches and flooding already inundated farms. Crops that had managed to survive

Connie's drenching were drowned by Diane's.

About 1,000 people were evacuated from low-lying areas, especially near sounds and rivers. In Belhaven, water was reported at 3 feet above street level in some stores. In New Bern's downtown district, the Neuse and Trent rivers swelled and carried waist-deep water into buildings.

Ione — For a little more than a month. residents of North Carolina's coastal counties had been walking in the mud and mire brought on by Connie and Diane. Then, on Sept. 19, 1955, Hurricane Ione made landfall at Salter Path, about 10 miles west of Morehead City.

Ione was a strong lady while swirling in the Atlantic, but quickly lost her gusto when she slammed into the beaches. But she brought a tremendous storm surge and another abundance of rain to our coast.

At New Bern, tides were reported to be more than 10 feet above normal, flooding at least 40 city blocks. Several hundred homes in the area were washed away.

Unlike Connie and Diane, Ione was a killer. Seven deaths were reported across the state, five from drowning and two from car accidents on rain-swollen roads.

In the 41-day period from the beginning of Connie to the end of Ione, unprecedented amounts of rain fell on North Carolina. At the National Weather Service substation at Hoffman Forest (near Maysville), almost 49 inches of rain were recorded.

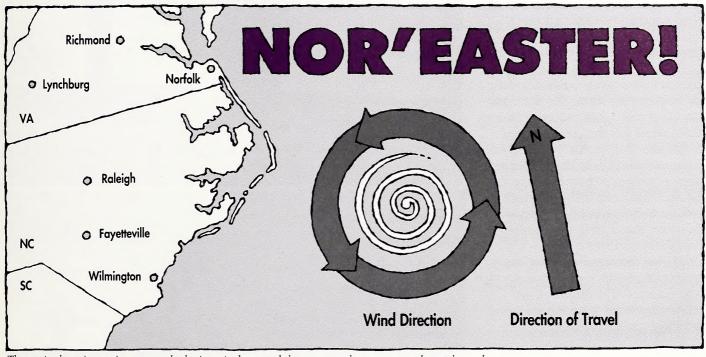
Will it happen again? Will Tar Heel residents face a similar onslaught of hurricanes in the future?

The answer, says Joe Pelissier, lies not in the minds of men, but in the fickle imagination of Mother Nature.

"If conditions are right, a hurricane will form," he says. "And a hurricane doesn't know it's heading for a certain area; there's nothing that directs it to the North Carolina coast in particular.

"We can do a certain amount of general prediction of hurricanes now," he says. "But where it's going to land, that's anyone's guess."

An Ash Wednesday to Remember



The typical nor'easter's counterclockwise winds pound the coast as the storm travels northward.

By C.R. Edgerton

Well-known Outer Banker David Stick called it "a horrifying experience."

Aycock Brown, the self-styled promoter of the state's easternmost barrier islands, labeled it "The Ash Wednesday Storm."

Meterologists call it "The Great Atlantic Coast Storm of 1962."

Whatever you name it, the 60-hour northeaster that pounded the Atlantic Coast from March 7 to 9 in 1962 was one of the worst non-hurricane storms to ever bring its fury to the Tar Heel coast.

Stick, who was in charge of implementing Dare County's emergency disaster plan on the North Banks, reports that more than 500 miles of shoreline along the Mid-Atlantic states were affected by the storm. He says total structural damage was estimated at \$234 million. About 1,800

dwellings were destroyed. Thousands more were heavily damaged.

The Ash Wednesday Storm was what meteorologists refer to as an extratropical cyclone. These storms have many of the same characteristics as a hurricane, but without the central warm air mass and the well-defined eve.

The primary problems associated with an extratropical cyclone are severe flooding and erosion, both of which were adundant during the Ash Wednesday Storm. The fury and power of this particular storm places it alongside many of the state's worst hurricanes.

To complicate matters, The Ash Wednesday Storm made landfall when the sun, moon and earth were aligned perfectly for one of the highest tides of the

Some of the footprints left in the sand by the Ash Wednesday Storm were:

- A 200-foot-wide inlet two miles north of Buxton (later filled in by the U.S. Army Corps of Engineers).
- Sinking of the Liberian tanker Gem about 100 miles southeast of Cape Hatteras. The ship split in half, and one crewman drowned.
- Total loss of the protective sand dune line from Kill Devil Hills to the Virginia line. Only the tallest dunes such as Jockey's Ridge and Penny Hill and those most inland were spared.
- Near record high tides of 8.2 feet (plus a storm surge of 3.6 feet) at Hatteras.
- Sustained winds of 60 mph recorded at Hatteras.
- Damage to hotels, motels, summer cottages, highways, piers and permanent residences estimated at \$12 million.

The Fisherman's Angle

By Carla B. Burgess

The sun has been ambivalent on this late summer day. Tucked beneath a blanket of rain clouds the color of steel wool, it emerges now and then in a teasing gesture during my drive east to Roanoke Island.

No rain has fallen, but in the 90-degree humidity, I almost want to wring the damp air like a towel. At Manteo, the clouds give way to a tentative shower, bringing the eighth straight day of rain to this coastal community.

I couldn't have picked a better day to talk to fishermen about weather and fishing. With the rain of the past week fresh on their minds and their decks too, the charter boat captains at Oregon Inlet Fishing Center are chatty.

My final destination for the day, the fishing center is as full of activity as a kicked-in anthill. The charters are just returning from their day at sea, and the sprinkle of rain has subsided.

I maneuver through the center carefully, ducking around throngs of charter fishermen and tourists with cameras admiring the catches of the day. The fish line the dock neatly like pelagic tick marks: bulky tuna, blunt-headed yellowish dolphin and skinny Spanish mackerel.

If I expect complaints about the weather, I hear no cross words from the captain of *The Sportsman*.

"Sometimes the bad weather helps you fish," says Omie Tillett. Inside the cabin, the Wanchese native looks weathered himself. He sits on the bench and leans back, clasping his hands together on his lap and stretching his tan, bare feet.

"Pretty weather is good 'cause you don't lose no trips. But too much of one thing is not good for anything," he says in a soft voice. "It takes a change in the weather to bring the fish in.

"A northeaster helps, but then it might cut you out of a week's work," he says, shrugging.

"The rain doesn't bother us too much," he says. "We're 35 to 40 miles out, and the



Omie Tillett

squalls just pass on through. You're not in it all day long."

Nearly 60 miles south, at the tip of Hatteras Island, Steve Hissey is not as forgiving. Four solid weeks of muggy, southwest winds have rendered small-boat offshore fishing in this neck of the woods "non-existent," he says. The co-owner of Pelican's Roost Tackle Shop in Hatteras is losing patience with Mother Nature.

"To me, the fish can feel the pressure changing. They feed better before a cold front and before a wind shift, but we've had nothing but rain the last week and a half," he says. "A southwest wind like this puts warm water on the beach and puts crabs in the surf. You can't keep bait on a line."

A customer in the store agrees. He's been fishing for flounder in the sound, using shrimp for bait. The only clamoring on his line today has come from calico crabs.

"I think the fish are confused because the weather's so confused," says Hissey, reaching for his ringing telephone. He looks up over his shoulder at his television, which is tuned to The Weather Channel.

"We got two more inches dumped on us today — I'm growing gills," he tells the caller. "I don't think we've weighed a citation pompano since you've been gone; the water's so awful."

It was a friend from Maryland, Hissey explains as he hangs up. He says he

Steve Hissey



a B. Burgess

on Weather and Fishing

receives nearly 3,000 calls each year about the weather and the fate of the fishing.

After all, fish are as picky about the weather — and about eating — as we are. Spanish mackerel like their water clean; rough winds and sloppy conditions in inshore waters don't make for pleasant dining.

However, Hissey says, you still have your bottom feeders - croaker, spot, mullet — if you can get to them. "If the wind blows too hard, the current is so strong you can't even fish for those; the grass blows in and tangles with the line."

Fishermen farther south can do without the rain their northern neighbors are being served. But pass the southwesterly wind, please, says Capt. Billy Truitt of Oriental later in the week. Truitt and his wife, Lucille, have spent their lives crabbing. fishing and shrimping in the waters of the Neuse River and Pamlico Sound.

"This rain we're having right now is the worst thing you could have for a fisherman," he says. "What makes good fishing here is a light sou'wester and dry weather." When the Outer Bankers have a northeast wind, "their tide comes in here and floods

amount of coliform bacteria in runoff. Sea Grant agent Bob Hines says; fisheries planes are flying over Bogue Sound telling clam fishermen to stop harvesting.

No matter where you are, storm conditions — especially thunder and lightning — have their own way of making fish moody.

"Fish don't bite that good during or after a lightning storm," says Sea Grant marine agent Jim Bahen.

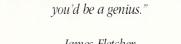
Capt. Eddie Haneman of Wilmington says fish know when to prepare for the tempest. "A lot of times the fish will feed right good, eating up for a storm," he says.

Even my dad has something to say on the subject. He's known fish to feed through all kinds of commotion.

"Some of the prettiest trout I have caught came off a northeaster," says Sam Burgess, describing a two-hour squall that

"If you could figure it all out, you wouldn't be fishing for a living; you'd be a genius."

James Fletcher

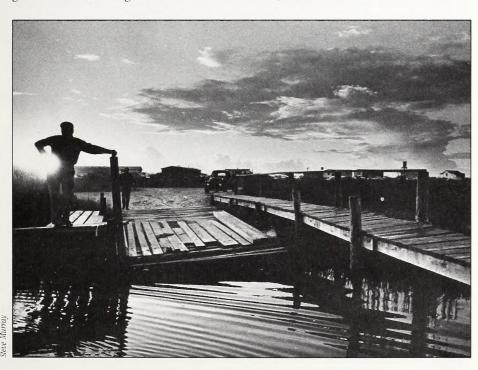


he and a buddy fished through on a Topsail Beach fishing pier. "The old pier just rocked; it rained; the wind blew."

Dad says he acquired a respectable mess of fish, and when the squall ended, the fishing did too. "When it left, the fish didn't bite another time. Not a nibble did they do," he says.

There's no set formula for weather and fishing. If there were, there probably wouldn't be fishermen who keep detailed logs of location, wind velocity and direction, barometric pressure and temperatures while they're out on the water.

Of all the folks I talked to, I think James Fletcher at Wanchese Fish Company said it best: "If you could figure it all out, you wouldn't be fishing for a living; you'd be a genius."



There's some irony to fishing, says Sea Grant agent Wayne Wescott of Manteo. "Northeasters blow our Gulf Stream in, and with that billfish, sailfish and blue marlin. It makes access to fishing better," he says.

"But on the other hand, if it's a northeast wind, it's probably going to be blowing too hard to go," Wescott says.

The fishing conditions desired at Hatteras or Oregon Inlet may be completely different from those sought at other points along North Carolina's scalloped-out coastline.

us," he says.

As for rain in this area, the prescribed amount is "just enough to suit the farm," Truitt says. Too many showers will fill the Neuse River and Pamlico Sound with undesirable runoff.

In the long run, rain itself can have a profound effect on various fisheries.

An overly wet spring can be bad for shrimping; the decrease in salinity can send young shrimp out of the estuaries in search of saltier water, where predation is high. This wet August has increased the

Of Bulls' Hides

By Carla B. Burgess

A sundog never fetched anything but a heap of bad weather.

So say Lucille and Billy Truitt of Oriental.

"We came from a long line of fishermen back in the 1700s, and they went by what the old Indians used to see," says Lucille. "A sundog, seeing two suns, means there's gonna be a sudden change — and we've seen a many of 'em."

Double suns and moons have long been seen as portents of bad weather. Even more feared are the lights of St. Elmo's fire dancing in a ship's rigging. Bloody sunrises don't sit well with sailors either, apparent in the saying, "Red sky at morning, sailors take warning. Red sky at night, sailors delight."

Throughout history, folks have set their beliefs and observations to rhyme, if not for poetic intent, then to make them easier to remember. Signs and sayings are woven tightly into the weather lore of fishermen and sailors.

And for people like the Truitts, who have fished the waters of the Neuse River

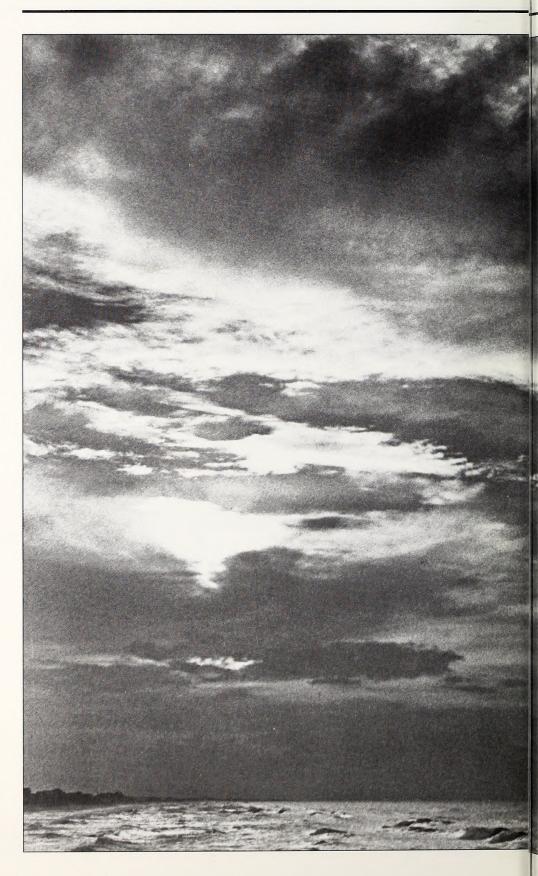
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When the glass falls low, Prepare for a blow; When it rises high, Let your kites fly.

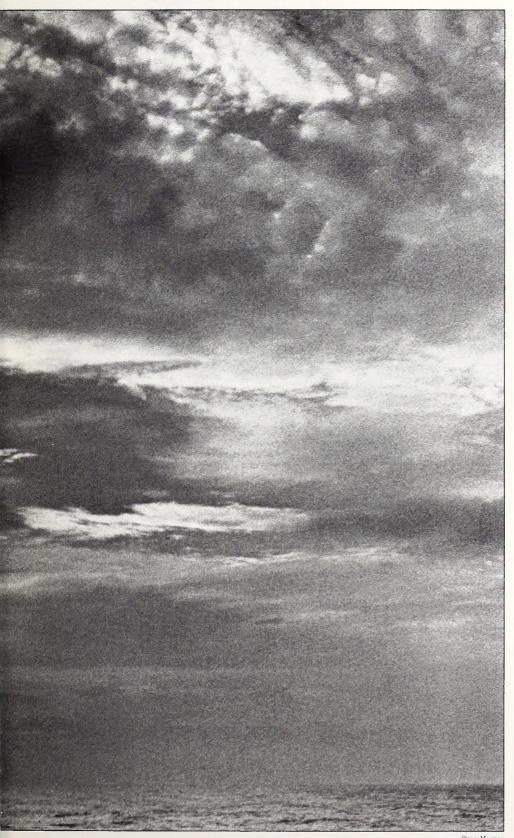
and Pamlico Sound most of their lives, they demand as much respect and attention as the local weather forecaster. Maybe more.

"A backing wind is no man's friend," says Arvin Midgett, who captains the charter boat *Miss Boo* out of Oregon Inlet. "I've known that saying all my life, and I've come to see the wisdom of it."

Counterclockwise winds almost always mean trouble — from colder air approaching to menacing hurricane winds. "If it (wind) comes from the northeast, back to the north, then from the northwest, why you look for another cold front coming through," says Midgett.



and Red Skies



Wind can affect the fish as much as the people catching them.

"We have a saying here, 'wind out of the east, fishing least,'" says Jim Bahen, a Sea Grant agent based at Kure Beach and a fisherman himself. "Fishermen up around Carteret talk about a 'mullet blow,' a wind out of the northeast that makes the fish move.

"The fisherman who relies on it (the weather) year-round has got a pretty good handle on his own method of predicting," says Bahen.

Cloud formations, the direction of the wind, even the behavior of animals are telling signs.

"Gulls way high up means there's a front moving in," says Bahen. "Biting flies, the wind's gonna change.

"Back in the old days, people living on the coast didn't have the weather forecast. They had to rely on local knowledge," he says.

If Billy Truitt sees "bulls' hides" and "mares' tails" in the sky, he's going to cut his fishing trip short.

"If there's a bunch of clouds looking

Rain on the flood, Only a scud. Rain on the ebb, Sailors to bed.

.

wife adds that you shouldn't let still waters

like buffalo running across the plains, it's gonna blow a gale that day," he says. His

fool you into thinking otherwise.

"Even if it's pretty and slick calm, you might as well know," Lucille Truitt says. "We'll go up a creek and anchor somewhere."

Capt. Eddie Haneman of Wilmington agrees that streaking clouds, which are caused by the wind, should not be ignored.

"Mackerel skies and mares' tails make loftier ships carry little sails," he says.

Breezing Through a Lesson in Weather

Wind is an important part of coastal weather conditions. At the beach or along the sound, wind affects work and play.

People who make their living on the water know that some winds are better than others for fishing and navigation. And of course, "blow boaters" and windsurfers depend on wind for their pleasure.

You don't need a fancy barometer or weather station information before you can learn about the weather. There's a lot you can find out just by feeling the wind and looking up at the sky.

A trip to the coast is a good time to learn.

The first thing you want to determine is from which direction the wind is blowing. After all, the source of the wind is what gives it its name. For example, a southwest wind is coming from the southwest, a northerly from the north, and so on.

Put your face into the wind, and turn your head so that you can feel, and maybe even hear, the wind equally in both ears. Once you sense a balance, your nose will be pointed toward the origin of the wind.

If you have trouble telling with your own nose, you might get some clues from sea birds perched atop pilings or standing on the beach. Which way are their beaks pointed? Gulls and terns usually face the wind. They don't like to have their feathers ruffled.

Once you've discovered the wind direction, notice its temperature. A southerly wind often brings warmth and humidity. Does the air seem almost tropical to you?

Winds out of the northeast are often cold. Hard northeasters sometimes bring fierce and lengthy storms.

Knowing the wind direction might help you decide where to tie up a boat or how to anchor it.



Carla B. E

Wind velocity or speed is another helpful thing to know. Admiral Sir Francis Beaufort of the Royal Navy invented a handy scale for determining wind speeds by watching waves.

If you're riding across a bridge at the coast or standing on a fishing pier, you're in a good position to observe the waves.

If you see only small wavelets and no foam, this is "light air," which ranks "1" on the Beaufort scale. The speed of the wind is between 1 and 3 mph. A "moderate breeze," numbered "4" on the scale, will whip the waves into whitecaps. Winds are between 13 and 18 mph.

A "strong breeze," ranking "6" on the scale, brings winds 25 to 31 mph. You should see cresting waves and "wind streaks" on the surface of the water. A wind streak is a straight line of foam pushed ahead of a wave.

There are some winds that are different from the "big" weather pattern. One kind of "local" coastal wind is the sea breeze.

During the day, the land warms more quickly than the ocean. So in the afternoon, the warm air over the land rises, pulling in cooler air from over the ocean. This cool air moving toward the shore is called the sea breeze.

Have you noticed when you're at the beach, gnats and mosquitos tend to be worse at dawn and dusk? There's no sea breeze to carry them away from you.

If you're just learning to waterski, you might fare better in the morning or late afternoon, when the sea breeze isn't chopping up the waves. On the other hand, if you're a beginning sailor you might choose mid-afternoon for better wind in your sails.

Good luck in your weather adventures! Carla B. Burgess

Natural Wonders of the Coast

Way Down Upon the Scuppernong River

"He won't bite. And if he does, it won't hurt too much."

With those strange words of assurance, David Wojnowski of Elizabeth City maneuvered his canoe — with the reluctant help of his canoeing partner — next to a gum log jutting into the Scuppernong River.

On the log, a brown water snake sunned himself.

In one swift move, Wojnowski grabbed the reptile and threw him into a cloth bag in the bottom of the canoe. The slight wind carried the musty scent of the frightened snake downriver.

Later, Wojnowski showed the other members of the canoeing party his right hand. Blood trickled from a series of tiny wounds on his knuckles. He smiled.

"It was worth it to get a snake like that," he said, explaining that he would keep the snake alive and show it to his students.

Snakes included, the Scuppernong River is one of North Carolina's best kept secrets.

Quiet and unassuming, the river's dark pocosin waters flow from just north of Lake Phelps to Albemarle Sound.

There are few signs of man.

No littered shorelines. No trampled banks. No fire rings or newly-blazed trails.

Perhaps this pristine beauty is the reason Lundie Spence, Sea Grant's marine education specialist, chose the Scuppernong River as one leg in her recent Paddle-to-the-Sea project. The program was designed to give science and math teachers from the state's northern coastal counties a chance to experience coastal nature first hand. In turn, that knowledge will be passed along to their students.

Wojnowski was one of those teachers. The five-day adventure traced the course of a single imaginary raindrop that



fell into a freshwater lake (Lake Phelps), wiggled its way into the Scuppernong, flowed into the Albemarle Sound estuary, and finally came to rest in the warm waters of the Gulf Stream off North Carolina's Cape Hatteras.

The teachers discovered the unique characteristics of Lake Phelps, retracing the probable course of Indians who paddled dugout cypress canoes on the lake centuries ago. They studied the huge trees in one of North Carolina's last remaining stands of virgin timber.

On the Scuppernong, they took water samples, noted the river's bankside flora and fauna and paddled to one of the last stands of Atlantic white cedar on the East Coast.

In Roanoke Sound, the teachers waded in ankle-deep water, took more water samples, collected more plants and animals, and gained an appreciation for the myriad forms of life in the estuary.

Finally, aboard a headboat in Oregon Inlet, they learned of the raindrop's final earthbound destination. They discovered how the raindrop squeezes through the inlet to mix with the offshore waters, eventually evaporating and returning to the sky.

Why all the fuss over a tiny raindrop?
"If you look at our state, you won't find any watershed system that is more compact than the one we chose for Paddle-to-the-Sea," Spence says. "From lake to river to estuary to ocean, it's all there"

Spence says it's important for teachers to instruct their students in the fundamental truth that a watershed is not just one lake or one river or one stream.

"They need to teach that a watershed is a whole system and that a commitment to teaching about the watershed is a commitment to teaching about the system," she says.

C.R. Edgerton

Extending Knowledge to the Coastal Community

Satellite Guides Fishermen to Their Catch

All offshore fishermen, recreational and commercial, know fishing is a hit or miss. Some days are good; other days you couldn't lure a fish to your line if you had the only bait on the Atlantic coast.

But what if you had a little help from above?

Not divine aid, mind you. But a satellite telling you where the fish are.

In an age when we use satellites to predict tomorrow's weather, to pinpoint Iraq's nuclear arsenal and to complete complicated communications connections, why not use these circling sensors to do a little fishing too?

Jim Bahen, Sea Grant's marine advisory agent at Ft. Fisher, thought the overhead orbs might be just what offshore fishermen needed to find the Gulf Stream. He knew that locating the meandering current of warm water often meant finding fish.

Pelagics such as marlin, wahoo, swordfish, dolphin and mackerel like the warmth of the Gulf Stream and rarely stray from the confines of its heated waters.

But finding this haven for fish can be tough.

"For a long time, people thought the Gulf Stream could always be found at the edge of the continental shelf," Bahen says. "But that just isn't true.

In reality, the warm-water current fluctuates in position, responding to the wind, current and storm patterns of the Atlantic. It can change location by several miles in just a few days time.

To find this wandering warmth, "fishermen used to spend a lot of time and fuel running around in the ocean looking at their temperature gauges," Bahen says.

But now Bahen has devised a system that can save commercial and recreational fishermen the search.

Several years ago, Bahen began talking to the folks at the National Oceanic and

Atmospheric Administration's National Environmental Satellite Service in Miami. They received satellite images that allowed them to plot the Gulf Stream.

Using infrared photography, a circling satellite could differentiate the warmth of the Gulf Stream from the colder surrounding waters of the Atlantic Ocean.

Only during summer when the continental shelf waters are heated to nearly the same temperature as the Gulf Stream is detection of the current's position impossible. But most of the year, the current could be accurately plotted.

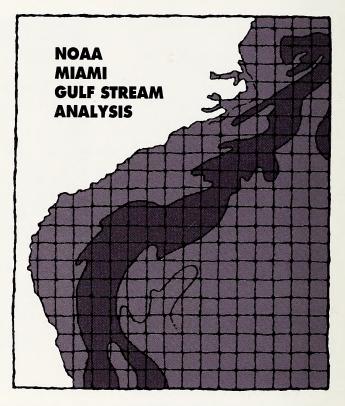
So Bahen decided to be the link between the readily available satellite information and the fishermen who needed it.

He began a service to send subscribers a weekly map charting the position of the Gulf Stream along the Eastern Seaboard. He charges \$20 a year to cover the cost of postage, envelopes and photocopying.

The map arrives on Wednesday, and Nancy Martin, Bahen's assistant, sends it to a mailing list of about 100 people.

She also encloses other Gulf Stream information — its speed, its direction, its average temperature and its width at various points along the East Coast.

Bahen says the subscribers to the service are varied. Most are recreational or commercial fishermen.



Several recreational anglers subscribe just so they'll know the Gulf Stream's location during the lucrative billfish and mackerel fishing tournaments.

For other anglers, it's the location of the unusual formations — peninsulas and eddies — that form along the current's boundary that make Bahen's chart a good investment.

Often warm-water pelagics are trapped in these pockets, not daring to venture into colder waters. Therefore these areas become prime fishing areas that would go unnoticed without Bahen's chart.

If you would like more information about Bahen's Gulf Stream chart, call him at 919/458-5498. If you would like to subscribe, send \$20 to: Gulf Stream Charts, Sea Grant, Box 130, Kure Beach, NC 28449. Make checks payable to Sea Grant.

Kathy Hart

The Science of Offshore Weather Patterns

If you could travel 30 miles east of Cape Hatteras on a cold January day and then shoot straight up about 15,000 feet, you'd see it.

You'd see warm, moist air rising off the Gulf Stream, like steam rising off a warm highway after a cool summer thunderstorm.

And if you looked west, toward the Appalachian Mountains, you'd see blue, cold air damming up in front of the mile-high range.

And, if you waited around long enough, you'd see a phenomenon unique to the Carolina coast: the formation of a major East Coast winter storm.

This event happens about 13 to 15 times every winter in the area over the ocean just east of Cape Hatteras.

These storms cause considerable headaches. Each year, they are responsible for millions of dollars in agricultural damage. And they are dangerous. In February 1989, the Presidents Day Storm paralyzed the East Coast with snow and ice. In April 1982, several people lost their lives when a Hatteras-formed storm dumped heavy snows in the Mid-Atlantic states.

Sea Grant researcher Len Pietrafesa, chairman of North Carolina State University's Department of Marine, Earth and Atmospheric Sciences, has teamed up with two other scientists — meteorology and oceanography professor Sethu Raman and graduate student Joe Cione — to study the



formation of these winter storms.

Their research should lead to a better understanding of the storms and more reliable methods for correctly predicting when and where they will occur.

"We've been looking at these storms through satellite images since 1978," Pietrafesa says. "And we discovered that the events that occur off Cape Hatteras are unique in the world."

Raman agrees. He says a "freezing line" of low pressure air forms off the coasts of Virginia and the Carolinas when the Gulf Stream begins its annual winter migration toward the Outer Banks.

Northeast winds roll down from the New England states into this low pressure formation, combining with the warm air over the Gulf Stream and the dammed up cold air from the mountains. "Nowhere in the world do you get this kind of heat flux," Raman says. Because of this, he says, these storms can sometimes form within the 12-hour span between weather balloon launchings.

"That's why these storms have been so unpredictable in the past," Pietrafesa says.

Now, however, with a better understanding of the upper atmospheric dynamics of such systems, predictions can be more accurate.

Pietrafesa says the more we know about these storms, the more we'll understand other processes that are affected by them — things like flooding, erosion, transport of sediments and fish spawning, the latter of which seems to occur more often just before these storms begin.

C.R.Edgerton

The Aft Deck

A Bulletin Board of Updates and Events

Know Your Regulations

The N.C. Department of Environment, Health and Natural Resources has published a guide to natural resource and environmental regulations. The 1991 North Carolina Environmental Permit Directory is a comprehensive introduction to environmental regulations and an overview of requirements governing the wise use and protection of the state's natural resources.

The directory can be used as a manual, or handbook, to guide businesses through the permit maze or as an educational primer for people interested in environmental protection.

The directory includes:

- a list of all state environmental and natural resource laws and their statutory citations;
- an informative grid that lists the environmental permits required for 40 businesses commonly operating in North Carolina:
- a series of frequently asked questions about permits:
 - a list of permit processing times; and
- a list of permits by area and by agency.

Each permit summary includes a description of the type of project requiring this permit, the statutory authority, the administrative code citation, the requirements, process time, fees and contact information.

The directory also includes regulatory requirements of other state and federal agencies such as the N.C. Department of Cultural Resources and the U.S. Army Corps of Engineers.

It costs \$5 and is available from: Department of Environment, Health and Natural Resources, Division of Planning and Assessment, P.O. Box 27687, Raleigh, NC 27611-7687.

Critical Coastal Concerns

The N.C. Division of Coastal Management needs the public's help in identifying the state's most critical coastal issues.

The 1990 reauthorization of the federal Coastal Zone Management Act created the Coastal Zone Enhancement Grants Program, which encourages achievement of coastal management goals. But to make the achievement of these goals responsive to public needs, the division needs your input.

Specifically, the division would like to know how you would rank the following

- protect, enhance or create coastal wetlands.
- prevent or reduce threats to life and property by controlling coastal development and redevelopment in hazard areas, and anticipate and manage the effects of sea level rise.
 - increase public access.
 - reduce marine debris.
- assess and manage the cumulative and secondary impacts of coastal growth and development.
- prepare and implement special area management plans.
 - plan for the use of ocean resources.
- adopt procedures and policies for siting energy and government facilities and activities.

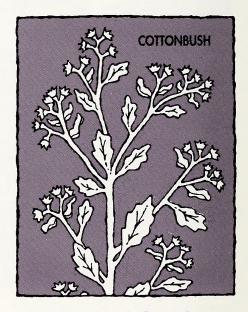
In addition to determining critical issues, the Division of Coastal Management is also seeking ideas on how to address these areas of concern.

With federal guidance and public input, the division will prepare a draft assessment. Public review and comments of the draft document will be accepted through the end of October.

Public forums to discuss the draft assessment are scheduled for Oct. 15 in Manteo at the N.C. Aquarium from 7 p.m. to 9 p.m., for Oct. 22 in Beaufort at the N.C. Maritime Museum from 7 p.m. to 9

p.m., and for Oct. 29 in Wilmington at the University of North Carolina at Wilmington (SB Building, Room 108) from 7 p.m. to 9 p.m.

If you have questions or comments about this procedure, contact Jim Wuenscher, N.C. Division of Coastal Management, P.O. Box 27687, Raleigh, NC 27611-7687. Or call 919/733-2293.



Fall Flora at the Shore

When the first cool air of fall finally pushes south, most people head westward to the mountains for a dose of seasonal beauty. But the coast also offers some spectacular examples of change.

Look first at the marshes, says Sea Grant marine education specialist Lundie Spence. Interspersed among the marsh grasses is the delicate sea lavender. Its fall bloom is a tiny purple flower.

Another plant, the short, segmented glasswort covers the salt barrens. Its fingerlike projections turn flame red in fall as the cool breezes cause the plant's green chlorophyll pigment to break down.

The groundsel tree graces the marsh's upland side, and this time of year, fluffy white hairs bearing tiny fruits reveal the plant's other name — cottonbush. Some

local people also call it mullet bush, perhaps because its fruiting coincides with the fall mullet runs.

Around the dunes, seaside goldenrod is in its glory now, and camphorweed, a beautiful yellow aster, is dotting the back of the dunes. In the depressions between dune tops, purple muhly catches dew, and the five-petal marsh pink still blooms.

Wax myrtle, a common coastal shrub, sprouts clusters of small bluish berries that call out the season.

While observing the splendor of the flora, you'll likely see the fall migration of the monarch butterfly. These beautiful butterflies migrate from Canada to Florida and central Mexico. They stop for food, feeding on the nectar of fall flowers such as goldenrods and camphorweed.

North Carolina's barrier islands, especially sites near inlets, are excellent locations to watch for these migrating beauties.

Crazy About Crab

This has been the year of the blue crab for coastal fishermen. The clawed crustaceans have been as abundant as mosquitoes on a windless night.

If you favor the sweet, succulent meat of this shellfish, now's the time to feed your need.

Most folks buy crab meat that is already cooked, picked and ready to eat.

Picked crab meat is available in several forms, says Joyce Taylor, Sea Grant's seafood education specialist. The four most common are lump, backfin, special and claw.

Lump, or jumbo lump, comes from the large white lumps taken from the area adjacent to the backfin appendage. Backfin consists of some lumps plus the rest of the meat from the body.

Special, also called regular or flake, is the white meat without any lumps. Claw meat, often a brownish color, is used in recipes where a white appearance is not important.

Picked crab meat is also available in pasteurized form, which extends its storage life. Pasteurized crab meat may be kept unopened in the refrigerator for up to six months.

And you can buy canned crab meat,

which needs no refrigeration as long as it is unopened.

Before using picked crab meat, always examine it for shell fragments, Taylor says. And remember that picked crab meat has been cooked. When using it in recipes, be sure not to overcook it, she says. You'll usually need to cook it just long enough to heat it thoroughly.

For a crabby taste treat, Taylor suggests this recipe:

Crab Meat and Mushrooms in Wine Sauce

1 pound backfin crab meat

2 T. margarine

2 T. flour

1/2 cup milk

1/2 cup dry white wine

1/2 tsp. dry mustard

1/4 tsp. dried tarragon

1/2 tsp. salt

1/4 tsp. freshly ground white pepper

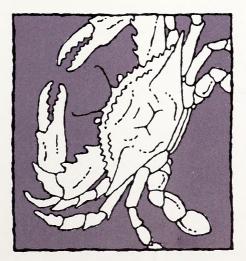
1/4 tsp. Tabasco sauce

1/4 pound sliced fresh mushrooms

3/4 cup dry bread crumbs

2 T. melted margarine

Melt 2 tablespoons margarine in large skillet over medium heat. Sauté mushrooms until tender. Blend in flour. Add milk, stirring constantly. Add wine, mustard, tarragon, salt, pepper and Tabasco. When heated, add crab meat and mushrooms. Place in lightly greased casserole. Sprinkle with bread crumbs and drizzle with melted margarine. Bake, uncovered, at 350 F for 30 minutes or until lightly browned and bubbly. Serves 4 to 6.



Oman Oasis

The Sultanate of Oman is an undiscovered Middle Eastern jewel.

Wide, sandy beaches and high, rugged mountains make Oman among the most beautiful of the arid countries of the Persian Gulf.

Walter Clark, Sea Grant's coastal and ocean law specialist, is working to make sure this oasis remains a viable environmental showcase.

Clark is one of a team of American, Canadian and German specialists whose ultimate goal is to write a set of rules and regulations that will protect Oman's coast from development brought on by an expected influx of tourism over the next few years.

Until recently, Oman was a closed country. Very few tourists were allowed in to witness her splendid shoreline beauty.

With the country's oil reserves expected to run out by the turn of the century, Oman's monarch, Sultan Quaboos Bin Said, wants to open the country to limited tourism.

But with people come problems.

The sultan is seeking ways to develop his country for tourism but leave the environment intact.

"It's called sustainable development," Clark says. "They want to allow development without destroying the resource that's attracting the development in the first place. They also want to preserve their cultural identity."

For Clark, it's an exciting adventure.

"We're going into a country that's relatively unspoiled," he says. "As a lawyer, to be involved with a project like this from the beginning is unique. We're usually trying to fix things after the fact."

Clark will interview government officials and look at information provided by a coastal engineer, a planner and a geomorphologist.

From that information, he will draft laws that will be reviewed by Oman's Ministry of Environment. From there, the laws are likely to become decrees of the sultan, and thus, law of the land.

The project is being sponsored by the United States Agency for International Development and administered by James Dobbin and Associates of Alexandria, Va.

Coastwatch wants to hear from you on topics relating to the North Carolina coast. Letters should be no longer than 250 words and should contain the author's name, address and telephone number. Letters may be edited for style. Send all correspondence to Coastwatch, UNC Sea Grant, Box 8605, North Carolina State University, Raleigh, NC 27695. Opinions expressed on this page are not necessarily those of UNC Sea Grant employees or staff.

Shaking A Bad Image

Dear Editor,

I am a resident of Carolina Beach and have been so for five years now. I read with much dismay your article regarding the comparison of our beaches (May/June 1991). I must tell you that I am weary of writers and everyone else constantly comparing the two beaches of Wrightsville and Carolina. It is apparent that Wrightsville Beach is an affluent town. However, much money and time has been spent by the taxpayers of Carolina Beach to build up and beautify our beach.

This beach is growing, and many, many new residents are moving in here each year. These people are no different from the people who reside over in Wrightsville Beach. The residents of Carolina Beach have taken pride in the accomplishments that have been made here. There are many positive aspects to our beach and the boardwalk is not one of them. However, if you were to go to Johnnie Mercer's Pier in Wrightsville Beach, you would see the very same situation. Your glowing report of Wrightsville is wonderful, but I really feel like you did not give Carolina Beach a fair shake and the credit it deserves for building up and becoming the beautiful beach that it is today. We who live here are proud to call Carolina Beach "Our Town."

Arlene L. King, Carolina Beach, N.C.

Don't Kill Sharks and **Rays Needlessly**

Dear Editor.

I had to write you to request a correction in the Sharks and Rays at the Point article (Backtalk, May/June 1991). In your article you stated: "If you catch a ray, exercise caution and cut or clip off the tail." It should say: "If you catch a ray and plan to keep it to eat, exercise caution and cut or clip off the tail." Maybe you just don't realize how many fishermen cut off the tails of skates and rays and then throw them back into the water to suffer and most likely die.

Roxanne D. Dorman, Wrightsville Beach, N.C.

Pier Muncher is a Bore

Dear Editor.

I have an odd question for you on the maintenance of piers in salt water. I live in retirement at Topsail Beach on Banks Channel - great place!

Eight or nine years ago, I was told if I removed the growth and barnacles from my pier several times in the warm weather, I could prolong the life of the pilings. This year is the first year I physically couldn't clean them myself so I paid a man to do the

Now I'm told that cleaning does no good except where my boat might rub against them.

True or false? I had a lot of good exercise these last few years and wonder if I did any good!

Margaret L. Moore, Holly Ridge, N.C.

Outside of abrasion to your boat, you needn't worry about barnacles, says Sea Grant coastal engineer Spencer Rogers. Barnacles don't damage the wood; they just hang around on the outside.

The real culprits in damage to wooden pilings and decks are shipworms and limnoria. The shipworm is a relative of the clam. It doesn't eat wood, but bores into it, creating tunnels in which to live. You can see only the tiny hole where the earthworm-sized creature pokes its head from and feeds. The destructive mazes within the wood remain bidden.

The limnoria, which is kin to a shrimp, does eat wood. This 1/4-inch creature will even munch through creosote. Its snackings leave a trademark hourglass-shaped piling.

The only way to guard against these nuisances is by using properly treated lumber (chromated copper arsenic is recommended) during construction. Existing untreated pilings are completely vulnerable to these creatures, which have been known to destroy a pier in less than six months.

Highs and Lows, Ebbs and Flows

Dear Editor.

How do they calculate high and low tide times? Eddie W. Scott, Mebane, N.C.

The variation of the tides is caused by the complex relationships between the earth, moon and sun. Although time tides vary widely from place to place, it is possible to predict high and low tides. Since tide times repeat themselves over the years, careful records of past tides aid in the prediction of current tides. The longer records are kept, the more accurate the prediction.

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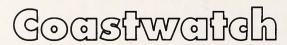
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Publications to Enrich Your Coastal Library

Sea Grant has some fresh offerings. Several new and reprinted publications, on a variety of topics, are hot off the presses.

THE SCOOP ON DIOXIN

What is dioxin? Where does it come from? How much of the chemical is in posted waters? Is it safe to eat fish from some rivers?

You'll find the answers to these and other questions in *Dioxin: Sources, Health Risks, Alternatives,* a four-page fact sheet developed by UNC Sea Grant and the N.C. Cooperative Extension Service.

The fact sheet provides answers for some of the public's most frequently asked questions about dioxin.

This chemical is produced as a by-product of the bleaching process in papermaking and has been found in risky quantities in fish and sediments in some of North Carolina's coastal waters.

This paper describes dioxin, its health risks, and ways to assure safe eating of fish that may be contaminated with the chemical.

For a free copy, write Sea Grant. Ask for UNC-SG-FS-91-01.

ARTIFICIAL REEF MANAGEMENT

People who fish or dive among artificial reefs in ocean waters off North Carolina, Texas and Florida were surveyed in this paper, which offers suggestions for management of these resources.

The 59-page report, *User Views of Artificial Reef Management in the Southeast*, profiles

artificial reef users and examines their general knowledge and use of artificial reefs. It also identifies their views on artificial reef administration, funding, siting, construction, information, evaluation, conflict experiences and acceptance of management restrictions.

For a copy, write Sea Grant. Ask for UNC-SG-91-03. The cost is \$3.50.

HOW TO HANG A GILL NET

Along the East Coast, gill nets are among the most popular nets for both commercial and sport fishing. The versatile gill net can be used to catch a variety of fish — from trout to hake and flounder.

It can easily be staked, anchored, allowed to drift or pulled by a boat.

Making your own gill net is one easy way to cut down on fishing costs. How to Hang a Gill Net outlines steps for doing this, including tips on buying the supplies, hanging the net, and following regulations.

For a copy, write to Sea Grant. Ask for UNC-SG-79-03. The cost for this 16-page, illustrated booklet is \$1.50.

PUBLICATIONS CATALOG

Sea Grant Publications has been reprinted and includes up-to-date listings of the books, booklets, brochures, posters and other materials published by our program.

Flip through our catalog,

and choose from informative publications on coastal topics of interest to you — recreation, fishing and aquaculture, seafood, education and our changing coast.

The publication is free. For a copy, write Sea Grant. Ask for UNC-SG-91-04.

SUCCULENT SURIMI

The Japanese have been eating it for years, and now it's popular in America too. What is the dish that has gained international popularity?

Surimi, It's a fish paste made from Alaska pollock, and it's shaped into pseudoseafood products such as crab flakes, crab legs and scallops.

Now Sea Grant researcher Tyre Lanier and the Technical Subcommittee of the Surimi Committe have standardized the procedure for evaluating the fish paste produced in the United States.

The procedure will allow surimi producers to accurately write reliable buyer-seller contracts, to ensure quality control and to predict the surimi's useability.

This standardization procedure is now available in a manual produced by Sea Grant and and the National Fisheries Institute.

For a copy of *A Manual of Standard Methods for Measuring and Specifying the Properties of Surimi*, write UNC Sea Grant. The cost is \$6. Ask for UNC-SG-91-01.

THE CAPE HATTERAS LIGHTHOUSE

Since 1871 the Cape Hatteras lighthouse has been a welcome sight for sailors entering the treacherous region off North Carolina's Outer Banks known as the Graveyard of the Atlantic.

At 208 feet high, it is the tallest lighthouse in the country and has been called North Carolina's most famous landmark.

Through the years, it has withstood the ravages of humans and nature, but its fate is in question. In *Cape Hatteras Lighthouse: Sentinel of the Shoals*, Dawson Carr tells the story of the noble lighthouse and speculates on its precarious future.

For ordering information about this 144-page paperback, call the University of North Carolina Press at 919/966-3561.

When ordering Sea Grant publications, please use your mailing label from Coastwatch or the customer identification number that appears above your name. This will speed delivery. Also be sure checks are made payable to Sea Grant, unless otherwise specified.

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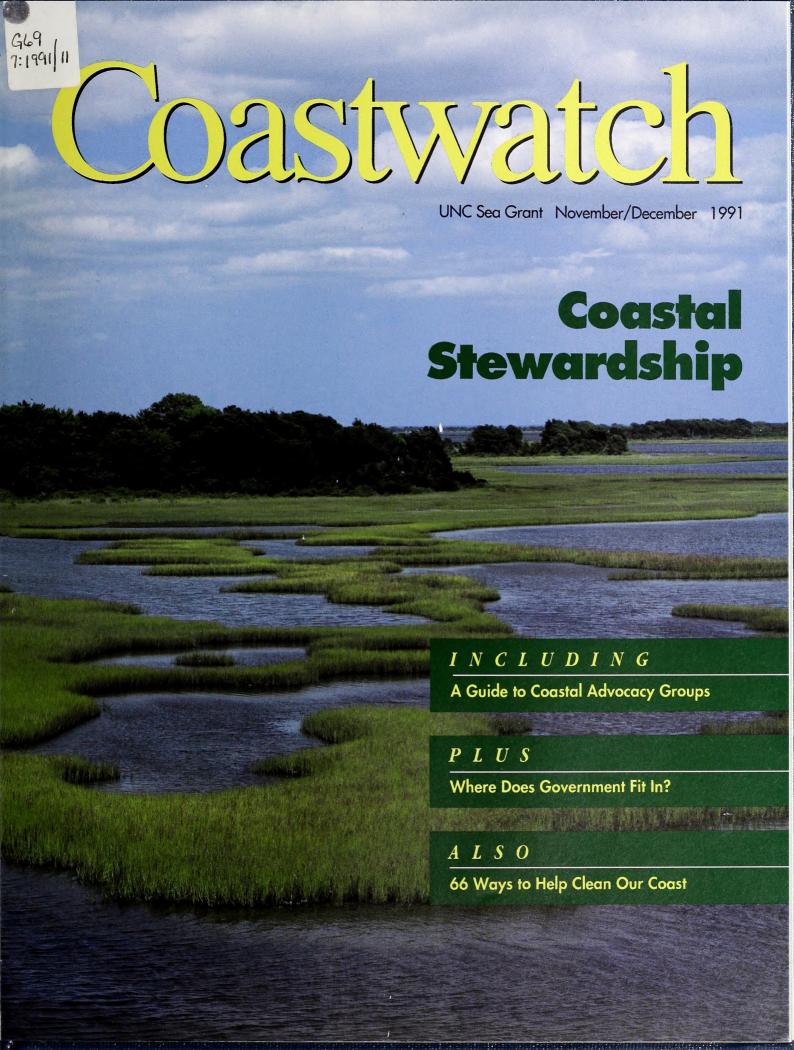


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Coastwatch

Coastwatch Staff:

Kathy Hart, *Managing Editor*C.R. Edgerton and Carla B. Burgess, *Staff Writers and Editors*L. Noble, *Designer*Julie Snyder and Debra Lynch, *Circulation Managers*

The University of North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, UNC Sea Grant supports several research projects, an 11-member extension program and three communicators. B.J. Copeland is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina.

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From The Top

DEC 10 1991

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Dear Readers.

This month, Coastwatch focuses on stewardship.

From the beaches to the sounds and seas, from national seashores to wildlife sanctuaries, we all can claim ownership of coastal resources.

And ownership carries the responsibility to wisely use and help manage these resources. Whether we work alone or seek the strength found in numbers, we can impact everything from local zoning ordinances to federal policies concerning use of offshore waters.

Carla Burgess gives us a rundown of some of the coastal

advocacy groups and their accomplishments and priorities for the future.

C.R. Edgerton takes a look at government's role in protecting the state's coastal resources. His article records the viewpoints of an environmental lobbyist and the director of the state's Division of Environmental Management.

And there's a list of 66 things you can do to help make the coast a more environmentally safe place to live and work.

> See you next time. Kathy Hart

In This Issue

Strength in Numbers: Pooling Resources to Make an Making Government Work for You 8 Young Mariners Marine Advice Clean Up Your Act and Care for Field Notes



Strength in Numbers: Pooling Resources to Make an Impact by Carla B. Burgess

The United States, captured at night by a space shuttle camera, is ablaze with incandescent light. Illuminated towns and cities form an almost perfect outline of our country's coast.

The result is more than just a pretty picture.

It's a graphic illustration of the dense population in our country's coastal plain. Demographers have predicted that by the end of this century, 75 percent of Americans will live within 75 miles of coastal waters. It's a prediction that some think has already come true.

Growth along the North Carolina coast is keeping with the trend. By the year 2000, populations in Dare, Carteret and New Hanover counties are expected to be triple the 1980 count.

With this shift comes an increased pressure on our watery natural resources and a growing concern over how to maintain and preserve them. The issues we face are countless — protection of wetlands, dwindling fresh water supplies, sewage disposal problems, waning fisheries, declining water quality, preservation of habitat. We all have a say in what happens.

"Portions of the coastal environment belong to all of us," says Michael Corcoran of the N.C. Wildlife Federation. "We need to exercise the rights of ownership."

Thousands of individuals are making their voices heard as members of a chorus. Conservationists have banded together to speak out on environmental regulations; developers have grouped to push for balance in economic growth.

No matter what the position, people have found that working together as an organized group increases their effectiveness and their ability to get relevant and accurate information.

Some of these groups are large in scope and familiar in name — Sierra Club, Nature Conservancy, Audubon Society. Others are small but determined.

All play a role in keeping an eye on our coast.



When a city drainage project clouded the waters of a Wilmington creek with clay last spring, nearby residents were a little concerned. But when a developer proposed a community pier to stretch 350 feet into the waterway, it was time to call a meeting.

"Hewlett's Creek is a small estuary, but it drains a very large area of our city," says Betsey Talley, chairman of the newly formed Hewlett's Creek Watershed Association. A primary nursery for shellfish, the creek is shallow — less than a foot in some areas at low tide, she says.

The residents worried about increased traffic and pollution. "There is simply not enough water to support boats, unless it's just a little johnboat," says Talley.

The association won its fight; the plans for the pier were withdrawn. But Talley and the other members didn't disband.

"We became aware of many things that needed our attention and that the residents along the creek needed to be better stewards of the area ourselves — to sort of watch these things and catch them before they happen," she says.





It sounds like something Todd Miller would say. And with good reason. The N.C. Coastal Federation's executive director was present at that first Hewlett's Creek meeting. He's continued to give advice as the group has worked to influence the county's land-use plan.

"We're trying to get citizens less reactive to a crisis and more involved in helping set the agenda for what happens on the coast," says Miller, who's been with the federation since its beginnings in 1982. "Too often people become aware of problems when it's really too late to do anything about them."

With 55 organizations under its umbrella and 2,800 individual members, the Coastal Federation seems to be everywhere at once: serving up seafood at coastal heritage festivals; joining other environmental groups in a lawsuit to protect remaining wetlands in the East Dismal Swamp; coaching a fledgling environmental group at a neighborhood meeting.

Recently, the federation has worked with citizen groups that want to have input into their local land-use plans. Under the state's Coastal Area Management Act, plans must be reviewed and updated every five years.

"Traditionally people have always relied on the feds or the state to take care of problems," says Miller. "But these local groups are really critical to seeing that adequate safeguards are being taken. Local governments have the power to take care of the coast but generally have not used it.

"We view our role as helping citizens to spend their time wisely if they want to do something to help the coast," he says. "We make sure they don't waste a lot of time barking up the wrong tree."

Pamlico-Tar River Foundation

If it were possible for the Coastal Federation to have a prize pupil, the Pamlico-Tar River Foundation would be a likely candidate.

"We're sort of the prototype of what we would want all the Coastal Federation groups to become," says executive director David McNaught. "The Coastal Federation is extremely valuable to us more as a colleague; we tend to be partners in most ventures."

Formed in 1980 over concerns about degradation of the Pamlico-Tar River watershed, the foundation provides education, advocacy, monitoring of water quality and scientific research. It also offers recreational outings to inspire an appreciation for this natural area.

The watershed, which spans 8,200 square miles, has been plagued in recent years by fish kills, nutrient pollution and nuisance algal blooms. Municipal sewage treatment plants have exceeded their effluent discharge limits; bottom grasses have vanished; commercial catches have declined.

But McNaught says the foundation can claim many victories.

Continued on the next page



In its early years, the foundation joined the National Wildlife Federation in successfully suing the U.S. Army Corps of Engineers, winning protection for peat-based wetlands in what is now the Alligator River National Wildlife Refuge.

In 1989, the watershed won a "nutrient sensitive" designation from the state Division of Environmental Management and special protection against nutrient input.

The foundation has worked with other environmental groups, industry and government to develop a new wastewater discharge permit for Texasgulf Inc. in Aurora. The company's proposed wastewater recycling system should reduce its phosphorus discharge into the Pamlico River by 90 percent.

PTRF's priorities for the future will include implementing a comprehensive management plan for the basin and "maximizing the degree of protection for wetland resources," McNaught says.

LegaSea

When Michael Egan moved to the Outer Banks from Louisiana in 1983, he brought with him more than a love for surfing. He came with some first-hand observations on the nature of the offshore oil drilling business.

"I worked on the cargo vessels that hauled cargo to the oil rigs in the Gulf," Egan says, describing the toxic wastes he saw spilled overboard and seeping from rigs. He says he left behind an area economically devastated by a transient industry and ruined by toxic pollution.

At Cape Hatteras, he found a surfing mecca and an unspoiled stretch of barrier island. But the oil industry was not far behind.

In 1981, the federal government sold 43 10-year leases off the North Carolina coast to major oil corporations for the purposes of drilling for oil and natural gas. In 1988, Mobile Oil Corp. submitted an exploration plan that proposed drilling 38 miles due east of Hatteras Island.

That's when Egan and his surfing friends got busy; LegaSea was born.

"I didn't want to see happen in North Carolina what happened in Louisiana," says Egan. "This is one of the last stretches of beaches that is pristine. There's a vibrant economy based on tourism and fishing, both of which are dependent on clean water and clean beaches.

"We began a process of educating ourselves," he says. Through newsletters and meetings, the group now educates the public, providing background on the issue, updates on legislative activity and information on how to take action.

And the group formulated its position and purpose — to fight offshore drilling until scientific research projects no negative impact on the marine environment or the socioeconomic stability of the coastal zone.

As the issue heats up, LegaSea has expanded beyond its core group of surfers; its 500 members include residents, recreational and commercial fishermen, hotel and motel owners, and real estate agents, Egan says.

In 1990, Congressman Walter B. Jones helped secure passage of the Outer Banks Protection Act, which postponed drilling approval until October 1991 and until the Secretary of the Interior can certify to Congress that the information is adequate. It also created a panel of scientists to review the environmental and socioeconomic impacts of oil exploration off the North Carolina coast.

This panel has released a draft report for peer review, says Donna Moffitt, director of the state's Outer Continental Shelf Office. A final report is expected by the end of the year.

In the meantime, the folks of LegaSea are employing an offensive strategy.

Egan and others are pushing for public support of a National Marine Sanctuary designation that would include the area off Cape Hatteras National Seashore known as "The Point." Under this federal program, established in 1972, unique marine areas receive

special study, considerations and protection. The proposed "Hatteras/Gulf Stream National Marine Sanctuary" would cover 1,000 square miles.

Egan believes that the area meets some of the criteria of sanctuary designation. In this zone, the Outer Continental Shelf drops from 20 to 1,000 fathoms, forming a 6,000 foot undersea cliff, he says.

Nearby, the cold northern waters of the Labrador Current meet the warm Gulf Stream, mixing northernmost and southernmost species of birds, marine mammals and fish.

Ocracoke Committee formed in opposition to a "monstrosity" — a 350-foot dock and pier proposed in August 1990 and now completed — says spokesperson Charles Runyon. Residents were worried about how increased boat traffic would threaten the sound, which supports lush eelgrass and "wonderful clamming," says Runyon.

The group appealed the developer's CAMA permit but was refused a hearing before the N.C. Coastal Resources Commission.

Represented by the Southern Environmental Law Center, the committee won a Superior Court judgment to rescind the permit, but the state is appealing, says the center's director.

The Ocracoke Committee continues to work with the county commissioners on a land-use plan update.

Carteret County Crossroads and its 500-plus members aim to preserve the natural and cultural environment of Carteret County, says president Allyn Powell. The group has invited people from the Corps of Engineers and the Southern Environmental Law Center to help educate their membership on the issue of wetlands preservation and development. They also closely follow the offshore drilling issue and activities of local military bases.

Sunset Beach Taxpayers Association has successfully fought zoning changes and blocked a high-rise bridge through legal action, says spokesperson Minnie Hunt.

Penderwatch and Conservancy monitors stream water quality, attends meetings of the county commissioners and planning board, and stays abreast of issues affecting quality of life in Pender County. Co-vice president Howard Sterne hopes the





organization of 800 members looks at issues "not in a 'not in my backyard way,' but in a fairly scientific way."

The Pender group has been a mentor for the newly formed Friends of Black River, who organized to oppose a proposed landfill near the river banks.

Friends of Hatteras Island is a group that fosters stewardship of the sands, air, woods and water of this barrier island.

The group is a voice for the state's largest remaining maritime forest, Buxton Woods. Friends of Hatteras formed in opposition to a large proposed development in the woods, which they saw as a threat to the island's water quality and supply.

Lobbying efforts by the group and a request by the Sierra Club for a state designation of the woods as an "area of environmental concern" prompted the Dare County Board of Commissioners to pass its own protective zoning ordinance.

Almost 500 acres of the woods are now under state control and 1,000 acres are national park land; the remaining 1,500 acres are privately owned.

Friends' secretary Ricki Shepherd hopes the state will acquire at least another 500 acres of the maritime forest.

In the meantime, the group has a lease-purchase agreement for a 10-acre soundside tract of Buxton Woods. They're planning a library and resource center in an existing building and are also constructing nature trails.

Friends of Roanoke Island advocates citizen involvement and empowerment in government and public education. The group holds land-use planning seminars, networks with other groups on wetlands issues and monitors water quality.

NORTH CAROLINA WILDLIFE FEDERATION

Started in 1945 by a group of hunters and fishermen, the N.C. Wildlife Federation has a long history of fighting for enhancement of natural resources statewide. Specifically, it prompted the legislation that created the state's Wildlife Resources Commission, says executive director Michael Corcoran.

Continued on the next page

In the early 1950s, the federation was fighting for stream sanitation laws. Today's 50,000-member organization continues its involvement in protecting the quality of water and surrounding habitats.

Coastal resources preservation is high on the organization's agenda, including intensified political activity on issues such as wetlands and outstanding resource waters, Corcoran says.

"We were very active in petitioning the Coastal Resources Commission not to back off its beach hardening prohibition," says Corcoran, noting that seawalls and groins make public beach disappear.

The organization has spawned another conservation organization, the N.C. Alliance for Conservation Action, a grassroots political lobbying group.

As for its combined bent toward sportsmen's issues and mainstream environmentalism, Corcoran says the Wildlife Federation's "muddy boot ecologists" are comfortable with their feet in both worlds. "While they love to hunt and fish, they're really committed and ardent conservationists," he says.

N.C. ENVIRONMENTAL DEFENSE FUND

If one polluter of a river can't afford to curb its own discharges, could it opt to clean up someone else's pollution instead?

It could under an innovative management plan proposed for the nutrient sensitive Tar-Pamlico watershed.

For example, a wastewater treatment plant might not be able to meet its discharge limits for nutrients without costly capital improvements. But under this plan, the plant could opt to invest in better agricultural practices on nearby farms, thus reducing nutrient-rich runoff in the watershed.

This alternative strategy, also called "pollution reduction trading," was developed by the N.C. Environmental Defense Fund and other environmental groups in cooperation with a coalition of dischargers in the basin.

"The philosophy behind our organization is creative problem solving, using legal, scientific and economic strategy," says EDF senior scientist Doug Rader.

EDF works closely with the Pamlico-Tar River Foundation and the N.C. Coastal Federation. Along with those groups and others, EDF helped develop a permit by which Texasgulf will reduce its phosphorus input into the Pamlico River, Rader says. It has also defended North Carolina's dioxin standards against assaults by the pulp-and-paper industry.

The organization's coastal agenda includes water quality protection and wetlands preservation, especially the unregulated conversion of forested wetlands to tree farms, Rader says.

NATURE CONSERVANCY

If environmental groups don't like the way land is treated, why don't they just buy it and manage it themselves?

That's exactly what the Nature Conservancy does. But the group isn't full of money. "We try to get it (property) as gifts; we



Clay Nole

take it free too," says Katherine Skinner, director of the state office.

The Nature Conservancy owns 31,000 acres in North Carolina and protects another 336,000 through conservation easements or ownership by a state or federal entity.

"Up and down the coast, we have some pretty interesting success stories," says Skinner, citing the donation of 118,000 acres now known as the Alligator River National Wildlife Refuge.

"Our mission is to protect endangered and threatened species and their natural communities," she says. "One of those communities is maritime forest."

The Nature Conservancy owns 420 acres in Nags Head Woods, its only staffed preserve in the state, and manages another 300 acres of the woods for the Town of Nags Head. Together, the town and the conservancy recently purchased another 389 acres of the forest.

Beech trees, big hickories and red oaks give Nags Head Woods a unique feel, says preserve director Jeffrey Smith.

"Most maritime forests in North Carolina are dominated by evergreen species that can withstand the harsh conditions along the coast, such as salt spray and lack of fresh water," he says. "Nags Head Woods is surrounded by a system of high dunes, so a very lush deciduous forest has grown up on this island right next to the ocean."

Thanks to the Nature Conservancy, this precious piece of nature has been preserved for future generations.

"The town of Southern Shores has been developed on what once was a maritime forest like Nags Head Woods," says Smith.

The Nature Conservancy is 600,000 members strong internationally; it counts 16,000 members in the Tar Heel State. The organization is tight-lipped about its future projects; such a disclosure could make land prices soar, Skinner says.

THE SIERRA CLUB AND THE AUDUBON SOCIETY

These established conservation groups also count coastal caretaking among their diverse priorities.

National flood insurance reform, offshore drilling, maritime forests, wetlands and water quality keeps N.C. Sierra Club coastal issues chair Ray Lee jumping.

The Audubon Society keeps an eye on 10 seaside sanctuaries from Southport to Ocracoke, says Walker Golder, manager of N.C. Coastal Islands program.

The program protects and manages this critical habitat — the primary nesting and feeding sites for 16 species and 13,000 nesting pairs of colonial waterbirds.

ECONOMIC ALLIANCE OF NORTH CAROLINA

There are plenty of groups to represent the pocosins and the piping plovers, but who speaks for the developer, the banker and the homebuilder?

"Someone has to create a voice that can strike the balance," says Ken Stewart, director of the Economic Alliance of North Carolina.

While environmental watchdogs are guarding the coast, the alliance is watching the watchdogs. And when the Environmental Management Commission, Corps of Engineers and Coastal Resources Commission meet, the alliance is there too.

Stewart says many environmental groups are "extreme" in their positions. The alliance, he says, figures compromise and leniency into its stance from the beginning. "We take the middle ground and fight for it tooth and nail," he says.

"We're not opposed to oceanfront setbacks or strong limits on oceanfront (shoreline) hardening structures," says Stewart, who is a former director of the state's Division of Coastal Management. "What we are opposed to is excessive regulations of any of these things that don't have technical foundation, that don't consider the effects on private property rights and economic development."

The alliance names among its members Weyerhaeuser and the developers of Landfall and Bald Head Island. But Stewart says there are many developers who "would not be welcome" in the organization.

N.C. MARINA ASSOCIATION

Construction of new marinas is often the catalyst for the

creation of citizen advocacy groups opposing development.

The N.C. Marina Association is a voice for the other side.

"The Marina Association is strongly in favor of a good environment," says executive director Susan Hebert. "But we also think regulations shouldn't kill small business."

The association keeps abreast of proposed policies and regulations governing marinas and seeks to represent and promote the marina industry.

Hebert says marinas probably get picked on by environmentalists "because they are highly visible and they border on industrial."

SOUTHERN ENVIRONMENTAL LAW CENTER

The natural resources of North Carolina and five other southern states have a legal leg to stand on, thanks to the Southern Environmental Law Center.

A substantial portion of this non-profit, public-interest law firm's legal resources is dedicated to coastal work, says Lark Hayes, director of the North Carolina office.

"Our relationship with coastal groups has enabled us to play an active role in most of the important coastal issues, including wetlands protection, maritime forest preservation, coastal water quality and offshore oil drilling," says Hayes.

The center is the pro bono counsel for the environment. Sometimes this means simply giving advice and counsel about strategies. Other times, "it means taking on a major legal battle to protect a special area or to get an important issue of coastal law resolved," she says.

SELC has 1,900 individual members and relies on foundation grants for sustenance.



Our story includes only a sampling of the established environmental, conservation and development groups in North Carolina. Many of them have literature and newsletters to keep the public apprised of coastal issues. Below are the contacts and numbers for the ones we mentioned:

N.C. Coastal Federation, Todd Miller, 919/393-8185 Hewlett's Creek Watershed Association, Betsey Talley, 919/791-4103 Pamlico-Tar River Foundation, Dave McNaught, 919/946-7211 LegaSea, Michael Egan, 919/473-5888 Ocracoke Committee, Charles Runyon, 919/928-5811 Carteret County Crossroads, Charles Runyon, 919/728-8769 Sunset Beach Taxpayers Association, Minnie Hunt, 919/579-2124 Penderwatch and Conservancy, Howard Sterne, 919/270-9733 Friends of Hatteras Island, Ricki Shepherd, 919/986-2703 Friends of Roanoke Island, Sybil Basnight, 919/473-6365 N.C. Wildlife Federation, Michael Corcoran, 919/833-1923 N.C. Environmental Defense Fund, Doug Rader, 919/821-7793 Nature Conservancy, Katherine Skinner, 919/967-7007 Sierra Club, Ray Lee, 919/830-0312 Audubon Society, Walker Golder, 919/256-9783 Economic Alliance of N.C., Ken Stewart, 919/256-2881 N.C. Marina Association, Susan Hebert, 919/249-0200 Southern Environmental Law Center, Lark Hayes, 919/967-1450

Making Government Work For You

by C.R. Edgerton

Some folks think the government is the last place to go for answers to coastal environmental problems.

But Bill Holman, a "green" lobbyist, and George Everett, one of state government's top environmental watchdogs, say the legislature is the best route to travel when protecting the state's natural resources.

Holman, a lobbyist for the Conservation Council of North Carolina and the N.C. Chapter of the Sierra Club, believes in solving environmental problems through legislation. It's the only sure way of guaranteeing your agenda, he says.

"The state's legislature is fairly representative of the people of North Carolina," he said. "And most of them take being a legislator seriously. That's why input from a lobbyist or input from citizens can make an impact."

Changing laws that may have an adverse affect on the environment takes time and effort. "It takes persistence and a long range goal," he says.

Sometimes you win. Sometimes you lose.

Here's an example.

Last year, Rep. Bruce Etheridge introduced a bill that would provide what Holman calls "modest" protection to the state's freshwater wetlands.

The bill was referred to the House Environment Committee and from there to a subcommittee. The subcommittee held informal hearings, inviting experts to comment on the bill.

"It was highly controversial," Holman says. "And it was strongly opposed by the forestry industry, the Homebuilders Association and the Martin Administration."

Opponents and proponents of the bill contacted supporters in their respective legislative districts. Because of the large volume of people against the bill, no vote was ever taken. It never left the subcommittee.

"The problem was that we (the proponents) got outworked and outspent by our opponents," Holman says. "But Etheridge used a parliamentary trick to keep the bill alive until the 1992 short session of the legislature. You can bet there'll be another major fight on the floor at that time."

In the case of the Etheridge bill, the environmentalists lost. Sometimes, the tables are turned.

"Some people, the Town of Topsail Beach in particular, thought the state's policy against constructing seawalls needed changing," Holman says. "And these people had been able to get the ear of the Coastal Resources Commission."

The CRC is a commission appointed by the governor to make decisions regarding regulations associated with the Coastal Area Management Act.

Hearings on the seawall policy were held in July and at that hearing — and in the mailboxes of CRC members — there was

overwhelming public support for maintaining the seawall ban.

"In this case, private citizens were able to sway the commission," Holman says. "It showed that working through the proper channels, through the government's own guidelines, you can make a difference."

Another important element in the success of the anti-seawall group was the fact that several environmental groups joined forces.

"Usually environmental groups work in coalition," he says. "It's easy to get frustrated and cynical, and change is often slow. You can do much if you work together."

There is strength in numbers, but sometimes the most successful work is done by an individual like Holman who, as a lobbyist, has one of the loneliest jobs in Raleigh.

"My job is to provide information to legislators," he says. "To educate them on why the Sierra Club, for example, supports a wetlands bill. I also inform environmentalists throughout the state





about what's going on in the legislature in order for them to participate."

He believes in what he calls "the heat and light theory."

"I provide information as "light" to the legislators," he says. "But there must be some heat with the light. You see, if they don't get the heat, they won't see the light.

"The information by itself won't convince them. They have to hear from their constituents. The letters people write, the phone calls they make, the public hearings they attend. All of it matters."

Walter Clark, Sea Grant's ocean and coastal law specialist agrees.

"I've seen citizens turn things around," Clark says. "And the more people you have, the better chance you have of being listened to."

Clark says not enough people know about the Administrative Procedures Act, a law that requires public hearings when regulations are being considered for change and that allows citizens to present petitions to amend, adopt or repeal any regulation.

"It is used by some groups, but it could be used more," he says. (For more about Clark's role in coastal environmental issues, see story on page 16).

Holman often urges his clients and fellow environmentalists to use every weapon at their disposal in what he calls "the fight."

Most legislators want to "do the right thing," Holman says. "When a politician is convinced that the majority of his or her constituents really care, he or she will be moved.

"We don't give up. The environmental community is persis-

tent. We win a lot of battles, but sometimes it seems we're losing the war. We need to win over the legislators. That's the only way to win in the long run."

While Holman and others like him can take sides in the war over the environment, there are others who can't plant their flags in either camp. Their jobs depend on being as neutral as possible.

Such is George Everett, director of the state's Division of Environmental Management. His branch of government administers and oversees the laws and regulations affecting the state's environmental well-being.

"People can come to us if they see something they don't like going on," Everett says. "For example, if someone sees an industry discharging an unusual amount of waste into waterways, we're the ones to call."

Environmental Management has offices in Wilmington, Morehead City, Washington and Elizabeth City, "So there's always someone from our department nearby," Everett says.

But calling on state-level government isn't always the most effective way to change things for the better on the coast, Everett says. Sometimes action has to be taken before the state gets involved.

"The best tool I've seen is the Division of Coastal Management's land-use planning statute," he says. "This allows local governments to determine zoning and other land-use practices. So, when the development is first proposed, private citizens can get involved in what will happen.

Continued on the next page

"Sometimes, we're not the one to call when you see something you don't like," he says. "These things need to be addressed much earlier, when the land-use plan for the county is being developed."

After the local decisions are made, the Coastal Resources Commission usually "goes with the lead" of local government. The local decisions are where most people can be the most effective.

"We don't want to be seen as the bully trying to tell people what to do," Everett says. "That's why the coastal planning statute was established."

Bully or not, state government is often seen as either the bad guy or as the genie in the lamp, Everett says. The challenge of his department is to stay neutral while protecting the state's natural resources.

It's a difficult row to hoe, especially when you're caught in the middle of the interests of a growing state that's already 10th in population in the nation.

"First, there's the environmentalists who, at the extreme end, don't want any more growth," he says. "And then there are those who want more growth and more jobs and a higher standard of

Can the technology of government and private sectors keep up with the growth?

"The growth will come and the improvements in how to handle it will come," Everett says. "What you hope is that they'll be close enough together so the environmental impacts are minimal."



When you see what you might consider an environmental violation on the coast, who you gonna call?

Pollution busters!

The following federal and state government agencies will take your calls on issues that relate to violations within their jurisdictions.

N.C. Department of Environment, Health and Natural Resources. On general environmental matters, this agency should be your first contact. There are offices in Wilmington, Morehead City, Washington and Elizabeth City (see DCM listing below for telephone numbers). The number for the main office in Raleigh is 919/733-2314. The regional offices will have personnel in a variety of sections. Depending on the nature of your concern, ask for air quality, water quality, groundwater or land resources.

N.C. Division of Marine Fisheries. DMF handles complaints about misuse or mistreatment of the state's fisheries. They have a toll-free hotline number: 1-800-682-2632. In Washington, the number is 919/946-6481. In Morehead City, the number is 919/726-7021. If you have concerns about inland or freshwater waterways, contact the state's Wildlife Resources Commission in Raleigh at 919/733-3391 (see additional WRC listing below).

N.C. Division of Coastal Management. If you have questions regarding what you may consider a violation of land-use regulations, call DCM. In Raleigh, the number is 919/ 733-2293. DCM has offices in Washington (919/946-6481), Morehead City (919/726-7081), Elizabeth City (919/264-3901) and Wilmington (919/395-3900).

U.S. Army Corps of Engineers. Questions regarding wetland disturbances should be directed to the Corps of Engineers. In Raleigh, they can be reached at 919/847-1707. On the coast, the Corps has offices in Wilmington (919/343-4720) and in Washington (919/975-3123).

N.C. Wildlife Resources Commission. Concerns about wildlife or waterfowl should be directed to the WRC. Their number in Raleigh is 919/733-7291. There are regional offices on the coast, but they are often difficult to reach. The U.S. Fish and Wildlife Service also maintains an important enforcement presence on the coast. Call them at their regional office in Washington at 919/946-3361.

(Information in this article was taken from A River of Opportunity, ©1991 by the Pamlico-Tar River Foundation, Inc. P.O. Box 1854, Washington, NC 27889. 919/946-7211.)

Clean Up Your Act and Care for Your Coast

by Kathy Hart

When it comes to protecting, caring for and determining how to develop our coastal environment, you can't expect government or advocacy groups to do all the work.

Proper stewardship of our coastal lands and waters begins with you, the individual who works, plays or lives by the sea.

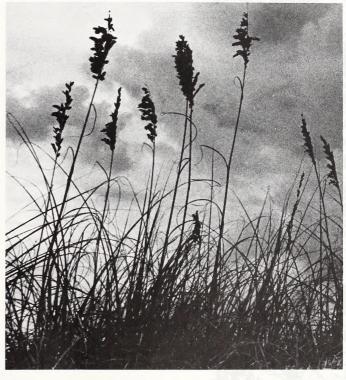
Below is a list of 66 action tips for a better coastal environment. Take a minute and read through them. The suggestions are simple and easy to apply to your lifestyle.

Even if you do not live along the sound or sea, your activities still have an effect. Undoubtedly, you live in the watershed of a river that eventually makes its way to the ocean.

IN YOUR HOME...

- **1** Recycle everything you can: newspapers, cans, glass, aluminum foil and pans, motor oil, scrap metal and plastics. Contact your local Keep America Beautiful coordinator, recycling manager or solid waste agency to find out what can be recycled in your area.
- **2.** Save your kitchen scraps (no meat) for the compost pile, and avoid use of a garbage disposal because it can add too many solids to an already overloaded home or municipal sewer system.
- **3.** Use reusable containers for storing food instead of plastic wraps and foil.
- **4.** Turn off the water when it's not actually in use while brushing your teeth, shaving, washing dishes and cleaning foods. A gallon of water can run out of your faucet in less than 60 seconds.
- **5** Fix leaks. A dripping faucet can waste 20 gallons of water per day; a leaky toilet, 200 gallons per day. To test your toilet for a leak, add a few drops of food coloring to the tank water. Color will show up in the bowl if there is a leak.
- **6.** Install a water-conserving showerhead. They are inexpensive and reduce flow by at least 25 percent.
- **7.** Place a plastic jug filled with water in the toilet tank to reduce the amount of water flushed.
- **8.** Wash only full loads in washing machines and dishwashers.
- **9.** Be sure faucets are completely off to eliminate dripping.
- **10.** Buy a suds-saver washing machine when you need to buy a new machine.

- **11.** Check for leaks outside. Faucets, hoses, hose connectors and sprinklers can leak.
- **12.** Don't put hazardous household substances paint thinner, paint, furniture polish, pesticides down your drain or in your trash. These products can pollute groundwater supplies, surface water or the air. Save these items for the special hazardous waste collection days sponsored by city and county governments.



Steve Murray

- 13. Choose household cleaners carefully by reading the label. Use the least toxic product available, and buy only what you need. Products labeled with "caution" are considered the least toxic. Those with "warning" are moderately toxic, and highly toxic chemicals are marked with the skull and crossbones. Be sure to keep the labels on products so you can properly identify and dispose of them.
- **14.** Clean with non-toxic substances such as baking soda, salt, vinegar, ammonia and elbow grease instead of bathroom and kitchen cleaners.
- **15.** Use sink baskets to prevent clogs, and plungers to fix them.

Continued on the next page

SEPTIC SYSTEMS...

- **16.** If your home is serviced by a septic system, be sure the system is in proper working order. Malfunctioning septic systems can pose health, pollution and contamination problems, particularly if they are located near estuaries and inland waterways.
- **17.** Know the location of all components of your septic system, and keep heavy vehicles away from the system.
- **18.** Don't plant trees or shrubs near drain lines. Roots can clog them.
- **19.** Distribute your laundry chores throughout the week to avoid overloading the system on any given day.
- **20.** Don't use toilets as trash cans.
- **21.** Have your septic tank inspected each year and pumped out every three to five years to remove solids.
- **22.** Do not build swimming pools near your septic system.
- **23.** If you're installing a septic system and encounter soils unsuitable for waste treatment, such as sand or clay, consider alternative septic treatment the low-pressure pipe and mound waste systems. (Sea Grant has a manual available for designing and installing each system. To receive a copy of either manual, write UNC Sea Grant. Each costs \$3. These manuals have allowed thousands of homeowners to install properly working septic systems in areas unsuitable for conventional treatment.)

IN YOUR YARD...

- **24.** Landscape with groundcover, trees and shrubs to minimize runoff. Plants help to prevent erosion, moderate summer heat and filter rainwater from downspouts and driveways.
- **25.** When landscaping, choose permeable surfaces such as wooden decks, porous pavement, bricks or stones rather than solidly paved surfaces to allow for better absorption of water into the soil.
- **26.** Divert rain from paved surfaces onto grass to permit gradual absorption.
- **27.** Choose appropriate plants, shrubs, trees and grasses for the soil in your area. Karl Graetz, a renowned coastal horticulturist, says many new beachfront homeowners try to landscape their yards with the same plants, grasses and trees they used at their former inland locations. Many of these plants simply won't survive the more harsh oceanfront environment or require copious amounts of water. It's better, Graetz says, to use native plants. (Consult your local nursery or write to Sea Grant for a copy of Graetz's *Seacoast Plants of the Carolinas*. The cost is \$4.50.)
- **28.** Test your soil to determine proper applications of fertilizers and lime for your lawn and shrubs. Consider using

- organic fertilizers, such as manure, to boost plant growth and condition your soil.
- **29.** Don't overwater your lawn.
- **30.** Pull weeds instead of using herbicides.
- **31.** Learn about natural insect controls as alternatives to pesticides.
- **32.** Use pest-resistant flowers and shrubs whenever possible.
- **33.** If you use pesticides, herbicides or fungicides, don't throw leftovers in the trash, down your drain or into a storm sewer. Properly dispose of all hazardous waste.
- **34.** Compost your leaves and yard debris. Burning them creates air pollution and putting them out with the trash is a waste of landfill space.
- **35.** Use mulch to conserve water in your garden and around your shrubbery.

ALONG THE SHORE...

- **36.** Remove obstructions from your creek, marsh or stream.
- **37.** Keep people, cars and grazing animals away from the edge of the water.
- **38.** Avoid heavy loads on the top of stream banks or shorelines.
- **39.** Control rainfall runoff through proper landscaping or engineered controls.
- **40.** Plant and protect vegetation on the slopes and adjacent areas of the shoreline.
- **4-1** Consult an engineer about structural solutions for controlling erosion. (Sea Grant's coastal engineer Spencer Rogers has written a how-to booklet for one method of controlling shoreline erosion. *A Homeowner's Guide to Estuarine Bulkheads* describes how to properly construct a bulkhead for use along estuaries, sounds, bays and tidal rivers. Write to Sea Grant for a copy; the cost is \$1. Rogers is also examining another method of shoreline erosion control breakwater-marsh, which combines small wooden breakwaters with planted marsh grasses. For more information about shoreline erosion controls, call Rogers at 919/458-5780.)

ALONG THE BEACH...

42. Don't walk or drive on the dunes. Dune vegetation is fragile and can't withstand constant trampling. Foot and vehicle traffic can wear openings in the dunes that weaken their defensive ability against storm erosion.

- **43.** Build crosswalks over the dunes to avoid foot traffic.
- **44.** Repair, restore or build dunes using sand fences and vegetation. (Send for Sea Grant's *Building and Stabilizing Coastal Dunes With Vegetation*. The cost is \$1.50.)
- **45.** Don't leave your litter behind after a day on the beach. Litter can kill aquatic life.
- **46.** Don't use the beaches as an ashtray. Instead use one of the portable ashtrays developed by R.J. Reynolds Tobacco Co. for outdoor use. If you're a smoker 21 years old or older and would like a portable ashtray, write R.J. Reynolds Tobacco Co., Portable Ashtray Offer, P.O. Box 2959, Winston-Salem, NC 27102. In your request, please state your date of birth. Allow four to six weeks for delivery. One ashtray will be provided per request.

IN YOUR CAR...

- **47.** A single quart of motor oil can contaminate 250,000 gallons of water more than 30 people will drink in a lifetime. Never dump motor oil, antifreeze, transmission fluid or other automobile chemicals into road gutters, storm drains or catch basins.
- **48.** Store waste oil in a container, and do not mix with gasoline, solvents or other liquids. This contaminates the oil, which may be reused, increases the volume of the waste and may form a more hazardous chemical.
- **49.** Find out if your local service station or car care center accepts waste oil.
- **50.** Many car detergents, like fertilizers, contain phosphate. When you wash your vehicle, uses non-phosphate detergents.
- **51.** Wash one section of the car at a time and rinse quickly. Use a hose that is high pressure, low volume and has a pistol-grip nozzle.
- **52.** Recycle your old tires or dispose of them properly. Do not toss them into our waterways.
- **53.** Keep a trash bag in your car. Don't litter.

ON YOUR BOAT...

54. Use onshore restrooms and pump-out facilities. Never release raw sewage into coastal waters. (Sea Grant has two free publications that can help boaters properly dispose of their raw sewage. *The \$10 Holding Tank* describes the materials needed and procedure for building a low-cost, onboard holding tank for use on small boats. *A Portable Transfer Tank for Boat Waste* lists materials and step-by-step instructions for constructing a low-cost tank for transferring sewage from boats with holding tanks to a marina's disposal system.)

- **55.** Go slow in your boat near banks where your wake can erode. Observe posted marine speed limits.
- **56.** Keep a garbage receptacle on board, keep it covered and make sure everyone uses it.
- **57.** Make it a rule that no trash goes overboard, including old fishing line.
- **58.** Make sure your motor does not leak gas or oil into the water. Do not drain engine fluid into the water. Be careful not to spill when adding oil to your engine.
- **59.** Place a bilge pillow in your bilge to remove oil from your bilge water.
- **60.** High phosphate soaps, toxic polishes and paints, stain removers, antifouling compounds and other similar maintenance products should not be used on or near the water, on boat ramps or in adjacent areas. Bottom scrapings are particularly toxic and should be not be allowed to enter the water.

TAKE A STAND...

- **61.** Promote wise land use. Attend public hearings held by local planning and zoning boards about development projects.
- **62.** Know the names of your elected officials at all levels of government. Correspond with them about issues that affect the quality of life in and around coastal waters.
- **63.** Read the legal notices in your local paper. Attend hearings on water issues and regulations in your area.
- **64.** Support efforts to preserve tidal wetlands, maritime forests and other natural coastal assets. Join a waterway cleanup effort such as The Big Sweep or join a Streamwatch group. Streamwatch groups choose a portion of a stream, creek, river or estuary and act as active stewards for these water bodies. They monitor water quality, remove litter and observe aquatic life. (To learn more about the N.C. Streamwatch program, contact state coordinator George Norris at 733-4064.)
- **65.** Lobby for prompt replacement of aging sewer lines and pumping stations and the improvement of sewage treatment plants in your area.
- Teach your children to respect and to value the environment. Take your children to one the N.C. Aquariums or the N.C. Maritime Museum. Or join next year's Big Sweep statewide waterway cleanup set for Sept. 19. It provides a hands-on education about litter in the aquatic environment.

(Sources for this story include: WCBS News 88 Earth Guide written by the New Jersey, New York and Connecticut Sea Grant Programs; Sound Advice written by WRAL-TV5 and the N.C Coastal Federation; and 100 Ways You can Help Save Our Environment compiled by the National Aquarium in Baltimore.)

Is There Enough Nature to Go Around?

Natural resources come in two types — those that are renewable, such as trees and fish, and those that are limited, such as coal and oil. People need to manage both so that we can continue to use them as long as we need them. Different methods can be used to manage resources.

In the Pacific Northwest, salmon are valuable fish. Fishermen catch salmon either in the ocean or in the rivers. To keep the salmon from being overfished, regulations allow only certain people to catch the fish at certain times.

In North Carolina, clams are a valuable resource. To manage them. regulations allow fishermen to use highly efficient mechanical harvesters only for short periods of time and only in certain areas. At other times, fishermen must use less efficient rakes or tongs to harvest these mollusks. The use of rakes and tongs prevent too many clams from being harvested.

Regulations also limit the size of clams that can be caught. Fishermen must throw clams less than 1-inch thick back into the estuary. Resource managers want clams to get large enough to reproduce, or spawn, future generations before they are harvested.

Almost all popular fish caught in North Carolina have restrictions that limit their capture. Scallops are harvested only for a few weeks each year. Blue crabs can't be captured from certain areas marked as crab spawning sanctuaries. Red snapper must be 12 inches long to assure that these fish reach maturity and spawn baby fish.

Resource managers also use fishing gear limitations to prevent overharvest. Most fishing nets have mesh size restrictions. This means that the holes in the mesh must be sized to catch only adult fish and not the youngsters.

And now Sea Grant fishing specialists are developing special types of nets that capture only certain things, such as shrimp. These nets have deflectors and openings that allow other young fish that the fishermen don't want to escape.

To learn more about resource management, get your teacher, scout leader or 4-H adviser to perform the following exercise with your group. You will need a bowl and three bags of goldfish crackers.

Assign the participants the following roles: First generation: grandma, grandpa. Second generation: son #1, son #2, daughter #1, daughter #2. Third generation: grandchild #1, grandchild #2, grandchild #3, grandchild #4, grandchild #5, grandchild #6, grandchild #7, grandchild #8.

Tell everyone that each generation wants to make a living fishing. Then begin the exercise.

Pour the contents of one goldfish bag in the bowl.

Let each grandparent fish from the bowl by scooping up a handful of fish. Let the grandparents decide if this is enough fish for them.

Let the second generation fish in the same way.

Let the third generation fish the same way too. Probably there will be no fish left for them.

What has been forgotten? Fish reproduce. Repeat the exercise, but add fish. After the first generation fishes, add two handfuls of fish to the bowl. After the second generation fishes, again add two handfuls of fish. Repeat after the third generation. You will probably still run out of goldfish before all of the grandchildren get a chance to fish.

Now ask the group these questions.

• Who did not get enough fish? Why?



- · How could the fish be conserved for each generation?
- Would you limit the number of people who could fish?
- Would you change the fishing method to allow use of only the thumb and forefinger?
- Would you allow a shorter time to fish?
- Would you set a limit for the number of fish that could be caught?

There are really no right answers to these questions. But the exercise does show how resources can be depleted and how complex resource management solutions can be.

(Source: Coastal Capers: A Marine Education Primer written by Lundie Spence and Vivian Coxe. This booklet contains 20 exercises designed to introduce elementary grade students to the marine environment. Coastal Capers is available from Sea Grant for \$3.50.)

A Howling Success

On a still night their howls pierce the air like arrows. Red wolves freely roam the 120,000 acres of the Alligator River National Wildlife Refuge on the mainland of Dare County.

They can be found in only a handful of places in the world. But their future in North Carolina is hopeful.

A native to North Carolina, the red wolf (*Canis rufus*) once freely roamed the Tar Heel coastal plain and the rest of the American Southeast.

The red wolf is smaller than the gray wolf (*Canis lupus*) but larger than the common coyote (*Canis latrans*). It is a tall and lanky animal, and its fur has coloration ranging from cinnamon red to charcoal gray. The colorings and body type are ideally suited for hunting in Southeastern habitats.

A creature of forests and bottomlands, the red wolf was eradicated from our state in the late 1930s. Humans were responsible for most of the red wolf's retreat. The government once offered bounties for their hides. And logging companies decimated their forest range.

In the 1960s, there were few red wolves left in the United States. A small area of marshland in Louisiana and Texas had become their home. But these animals were sick, and some had mated with native coyotes, resulting in a hybrid breed.

In 1986, new hope was born for this small wolf in North Carolina. Four pairs of wolves were taken from a captive breeding program in Tacoma, Washington and released into the Alligator River National Wildlife Refuge.

Later, others were released. They were fed by U.S. Fish and Wildlife Service biologists until they were able to fend for themselves.

Even the bottomlands of this remote wildlife refuge weren't enough to protect these wolves from the influence of humans. Two of the red wolves released into the refuge were killed by passing motorists.

Nature took its toll also. Some wolves died of disease; others fell victim to accidents.

But biologists aren't gauging the success of the North Carolina red wolf project by the number of animals that survive. They're watching for breeding successes. In 1989, two litters of two pups each were recorded, with one pup from each litter surviving.

And this spring, four litters were documented. One of those litters was born to a female who had been born in the wild.

"It's the first time we've had second-generation red wolves in the refuge," says refuge biologist Michael Morse.

The red wolf is considered extinct in the wild and is one of the most endangered carnivores in the world, with its population



hovering at about 130 animals, Morse says.

If the Tar Heel project is successful, the Alligator River National Wildlife Refuge may become one of only three refuges in the country where this canid will once again roam the wild.

Today, there are about 25 red wolves at Alligator River, the limit for the refuge's ability to support wolves.

"If the population grows consistently, surplus animals will have to be captured and kept in pens or taken to other sites," Morse says.

One such site is the Cades Cove area in the Great Smoky Mountains National Park, where four red wolves were released this year.

For now, the future of the red wolf is uncertain. With more and more of the wolves' natural habitat falling prey to the lumberman's axe and the developer's shovel, choice reintroduction sites will diminish.

Their only hope, Morse says, is the salvation of large areas of habitat like that found along the Alligator River.

C.R. Edgerton

K.D. Zotte



Extending Knowledge to the Coastal Community

Taking the Middle Road

When you think of protecting the coastal environment, it's hard not to take sides.

But to Walter Clark, Sea Grant's ocean and coastal law specialist, not taking sides is a special calling.

Clark is an expert whose job demands that he maintain a middle-of-the-road posture.

"I can give people information on the law, what the law says about public trust, riparian rights, things like that," Clark says. "But I can't represent them."

Clark, one of the few Sea Grant coastal law specialists in the nation, is always in demand as a purveyor of information. And most of that is in the form of advice.

"I always tell people to get involved in the lawmaking process," he says.

In North Carolina, various commissions are charged with adopting and modifying regulations. During the process of changing these regulations, public hearings must be held. These hearings are an ideal place for an individual to affect change and to be heard, Clark says.

I always tell people to get involved in the lawmaking process.

"The best thing a person can do in this situation is to do their homework," he says. "They should go into a hearing prepared. They should follow the procedures set up by the commission that's holding the hearing. And they should make their point calmly and clearly and back up their point with information."

In what coastal issues are people getting involved?

Clark sees at least four major issues affecting North Carolina's shoreline: the quality of coastal water, the increasing conflict between users of the state's waterways, wetlands protection — particularly freshwater wetlands — and increasing pressures on oceanfront development from eroding shorelines.

The best thing a person can do in this situation is to do their homework.

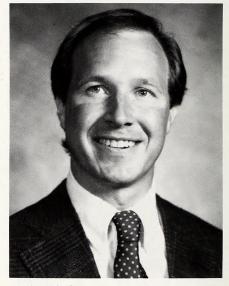
"Water quality is the number one issue," he says. "And there's particular interest in identifying non-point sources of pollution.

"Over the years, we've gotten a fairly good handle on point-source, but the non-points are harder to deal with. Solutions to the non-point source problem will include stricter regulations on land-use practices.

"Then there's the public trust issue," he says. "As the coast gets more crowded, tension develops between users of the public waters — fishermen, boaters, swimmers — and owners of private property adjacent to the public waters. New rules and regulations will likely be enacted."

As for oceanfront development, Clark sees greater activity as more development becomes endangered by eroding shorelines. This will test the strength of our coastal management program's oceanfront regulations, he predicts.

"The wetlands issue is very important," Clark says. "In North Carolina, we have developed a management program for identifying and protecting saltwater wetlands. We are struggling now with doing the same thing for freshwater wetlands."



Walter Clark

Finding a balance with these and other issues is difficult, but seeking ways to achieve the balance is Clark's job.

People in government and academia aren't supposed to be influenced by one side or the other.
We're in search of the truth.

"People in government and academia aren't supposed to be influenced by one side or the other. We're in search of the truth," he says.

Sometimes that truth may support a particular point of view, Clark says. Still, he must walk a straight line and not get personally involved.

"At times," he says, "it's a hard line to walk."

C.R. Edgerton



Field Notes

Insights into Current Sea Grant Research

Stalking a Dangerous Bacteria

When Jim Oliver has a bushel of oysters delivered to his Charlotte address, his mind isn't on eating the delectable mollusks. Far from it.

These oysters are destined for intense probing in a university laboratory as this Sea Grant researcher tries to unravel the mysterious behavior of a deadly bacteria sometimes carried by the mollusks.

The bacteria, *vibrio vulnificus*, can be deadly for people who suffer from liver ailments or immune deficiency diseases if they eat infected oysters raw or partially steamed. Properly cooked, the infected oysters pose no threat even to people with underlying illnesses, says David Green, Sea Grant's seafood technology specialist.

Even healthy individuals should consider cooking their shellfish to an internal temperature of 160 F, Green says. Consumption of any raw meat or seafood can pose some health risks.

Vibrio vulnificus is part of a larger family of bacteria known simply as vibrio. Thirty species of vibrio have been counted, and 10 are known human pathogens, Oliver says.

These species of vibrio that affect humans act as gastrointestinal pathogens that cause food-poisoning symptoms — cramps, diarrhea and vomiting. *Vibrio cholerae* is responsible for the recent outbreak of cholera in South America.

Not all oysters carry *vibrio vulnificus*, although the bacteria is a common pathogen found in estuarine and ocean waters along the Atlantic, Gulf and Pacific coasts. But even those shellfish contaminated with the bacteria are not always infectious.

It's all of these ifs, ands and buts about *vibrio vulnificus* that has researchers such as Oliver at the University of North Carolina at Charlotte and Sea Grant scientist Gary Rodrick at the University of Florida trying to find some answers.

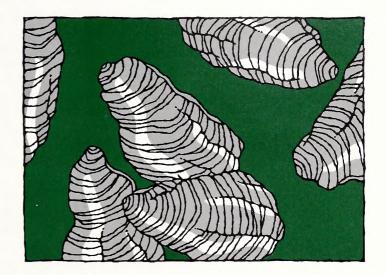
So far, most of the illnesses and deaths resulting from this bacteria have been traced to oysters harvested from waters warmer than 68 F. And people can contract the bacteria directly from the water through open wounds.

It affects mostly men over 40 years old who have a preexisting disease, commonly cirrhosis of the liver.

Unfortunately, when vibrio vulnificus strikes, it strikes fast.

The onset of symptoms — fever, chills, nausea, vomiting and secondary lesions — can begin in as little as seven hours after consumption of contaminated shellfish, Oliver says. And it is not uncommon for patients to die two to four hours after admission to a hospital.

But if diagnosed quickly, victims are treatable, Green says. The good news is that reports of *vibrio vulnificus* infections



are not common — only one per 200,000 people per year.

And Oliver would like to make them even rarer, better still, nonexistent.

He has been examining ways to rid contaminated oysters of this potentially deadly pathogen.

It was once thought the disease was more prevalent in oysters that were transported for long distances and sometimes allowed to get too warm. But Oliver's recent Sea Grant studies proved that temperature did not affect the growth of this bacteria in shellfish.

Also, scientists believed that the threat of this vibrio could be reduced through depuration. This means that oysters would be placed in clean water void of the bacteria and allowed to purge themselves.

Depuration worked for oysters that were infected with the bacteria in the laboratory, Oliver says. But it didn't faze oysters that were contaminated naturally.

Despite this grim news, Oliver says that there is new hope in the discovery of two strains of *vibrio vulnificus*. One strain is infectious; the other is not.

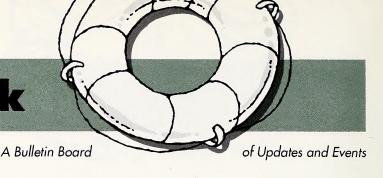
Oliver and other scientists are now looking for the genetic switch that would allow them to convert the infectious strain of this vibrio to the non-infectious form.

But for now, for those at risk, the only sure way to eat oysters is to have them well-cooked.

Meanwhile, the Food and Drug Administration and other seafood experts are doing their best to warn those who are susceptible while allaying the fears of those who aren't.

Kathy Hart

The Aft Deck



"Search" Looks at Sea Grant

Sea Grant researchers and agents will be featured on a television program set to air in January.

"Search," a series produced by N.C. State University's Broadcast Services for N.C. Public Television, is designed to focus attention on scientists and researchers from schools in the UNC system and elsewhere in the state.

During the 30-minute program dedicated to Sea Grant, coastal engineer Spencer Rogers discusses breakwatermarsh as a means of erosion control, marine advisory agent Skip Kemp talks about clam breeding and shellfish management, and marine agent Wayne Wescott relays his crab shedding expertise.

Also featured are Sea Grant's seafood technology specialist David Green, researcher Steve Broome and Sea Grant Director B.J. Copeland.

Features from the "Search" series are packaged for distribution and are often reaired nationally and internationally.

The series is tentatively scheduled to air four Tuesdays in January. Check your local listings for program dates and times.

Say Merry Christmas With Shrimp

Why not add festive flair and ocean flavor to your holiday hors d'oeuvres with a shrimp Christmas tree?

Joyce Taylor, Sea Grant's seafood education specialist, says the tree is easy to assemble and offers a light, tasty alternative to the heavy hors d'oeuvres and calorie-ridden sweets that abound during the holiday season.

Shrimp Christmas Tree

2 lbs. medium shrimp 1 bunch curly endive 1 foam cone, 1 1/2 feet tall 1 small box round toothpicks cocktail sauce

Place shrimp in boiling salted or seasoned water. Cover and simmer about five minutes or until shrimp are pink and tender. Drain. Peel shrimp. Devein if desired. Chill.

Separate, wash and dry endive. Starting at the base of the foam cone and working up, cover the cone with overlapping leaves of endive. Fasten endive to the cone with toothpick halves. Cover fully with greens to resemble Christmas tree. Attach shrimp to the tree in loose spirals with toothpicks (see drawing at right).

For flair, add a red bow to the top of your tree. Provide cocktail sauce in nearby bowl for dipping shrimp.

Cocktail Sauce

1 1/2 cups catsup

1 T. lemon juice

1 T. Worcestershire sauce

2 T. horseradish

1 1/2 tsp. sugar

1/4 tsp. or more Tabasco

salt and pepper to taste

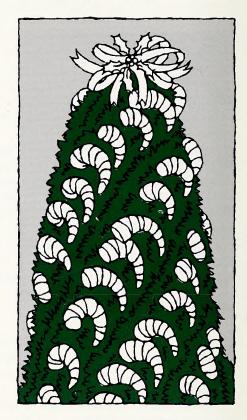
Combine all ingredients and chill.

Taylor says the tree can be assembled several hours in advance. But be sure the tree is tightly wrapped in plastic wrap to keep the shrimp from drying out and returned to the refrigerator for chilling. Be sure to keep the shrimp tree under refrigeration until serving.

For other seafood appetizers — crabstuffed tomatoes, crab dip, hot crab spread and smoked fish spread — fit for holiday fare, write to Joyce Taylor, N.C. State University Seafood Laboratory, P.O. Box 1137, Morehead City, NC 28557.

Ask for the Sept./Oct. hors d'oeuvre issue of Mariner's Menu, the bimonthly consumer seafood newsletter produced by Taylor. While you're requesting this issue, why not subscribe to this free newsletter. It's full of fish and shellfish recipes and consumer information. A subscription

would also make an excellent gift for friends who love to cook.



FDA Head **Talks Safety**

Thomas Billy, director of the Food and Drug Administration's new Office of Seafood, recently outlined new FDA initiatives for fish and shellfish safety at the Seafood and Environment Symposium hosted by Sea Grant in Raleigh.

Billy told an audience of seafood scientists and technologists that Congress had budgeted an additional \$9.5 million last fiscal year and \$6 million for the upcoming fiscal year to increase seafood inspection and to allay public fears about seafood contamination and disease risks.

Much of the public's fear about the safety of seafood is unfounded, Billy says. Only the consumption of raw shellfish poses significant health risk — but no more risk than eating any other uncooked meat.

To increase the public's confidence in fish and shellfish, the FDA will initiate the following steps:

- Audit all state's shellfish growing waters to ensure that waters open to harvest are not polluted.
- Develop an inspector training program.
- Clamp down on bootleggers who illegally harvest shellfish from areas closed to harvest because of pollution.
- Evaluate and possibly approve a new commerical kit to test for ciguatera a toxin found in tropical reef fish.
- Double the level of FDA chemical contamination monitoring in the United States and develop a new target list of contaminants.
- Visit all of the more than 3,000 seafood processing plants in the United States.
- Raise the U.S. seafood decomposition minimums to zero, mimicking Canadian standards.
- Increase inspection of imported seafood.
- Expand consumer education efforts to include brochures on home handling of seafood, a consumer hotline and information to specific audiences who are at higher risk for seafood-related illnesses.
- Improve the reporting procedure and database for seafood illnesses.

Sweep Nets Tons of Trash

Nearly 12,000 volunteers swept North Carolina's waterways clean of 212 tons of trash Sept. 21 in the First Citizens Bank Big Sweep. It was the most successful waterway cleanup in the five-year history of this Tar Heel event.

At nearly 300 sites statewide, volunteers collected scores of plastic bags and bottles, mounds of cigarette butts, miles of monofilament line and mountains of tires.

At inland sites, sweepers filled dumpsters and pickup trucks with refrigerators, stoves, sofas, television sets, shopping carts, bed frames, box springs, car batteries, toilets and, yes, even the proverbial kitchen sink.

Unusual finds included love letters, an artificial limb, a carousel horse, a sequined headdress, a Spanish laundry detergent bottle and a safe stolen during a robbery.

This year, volunteers also made some gruesome finds. In Craven County, volunteers found a dead turtle entangled

in fishing line. Along the Tar River, they found the grim result of a curious puppy's fatal entrapment in a plastic milk jug.

But two animal entrapments had a happy ending. Volunteers at the Fort Fisher State Recreation Area released a sea turtle entangled in fishing line. And at nearby Carolina Beach, a seagull was freed from a fishing hook.

Big Sweep organizers noticed several trends in this year's cleanup.

Beaches were cleaner of large items, but they were virtual public ashtrays for cigarette butts, volunteers reported. Sweepers at one site at Emerald Isle counted and bagged 10,520 butts.

Inland volunteers and coordinators noticed an increase in the number of appliances and tires being dumped into our state's waterways.

"I earnestly think this is because of ignorance and laziness in getting materials to the landfill," says Big Sweep Coordinator Cecilia McDaniel Brown of Keep Winston-Salem Beautiful.

With a successful cleanup completed, plans are already under way for next year's cleanup set for Sept. 19.

Big Sweep was made possible by generous contributions from: First Citizens Bank, Yadkin Inc., Alcoa Badin Works, Alcoa Foundation, R.J. Reynolds Tobacco Co., N.C. Wildlife Federation, N.C. Wildlife Resources Commission, N.C. Beer Wholesalers, Texasgulf Inc., MCI, Duke Power Co., CP&L, the Tennessee Valley Authority, WGHPiedmont 8, WRAL-TV5, WLOS-TV, WITN-TV and WWAY-TV.

The Big Sweep is coordinated by: UNC Sea Grant, Keep America Beautiful, N.C. Division of Coastal Management, N.C. Division of Water Resources, N.C. Division of Environmental Management, N.C. Wildlife Resources Commission, N.C. Wildlife Federation, N.C. Division of Parks and Recreation, N.C. 4-H, Keep North Carolina Clean and Beautiful, WGHPiedmont 8, WRAL-TV5, WLOS, WITN and WWAY.

A Pat on the Back

Two Sea Grant employees have recently been recognized for their achievements.

Skip Kemp, a Sea Grant marine advisory agent at Bogue Banks, was

awarded the 1990-91 Chancellor's Outstanding Extension Service Award for his work with shellfish aquaculture and estuarine leaseholders.

Kemp has worked to increase the private culture of clams, oysters and scallops and turn these shellfish farming experiments into viable new coastal businesses.

Debra Lynch, who heads the Marine Advisory Service secretarial staff, was awarded a 1991 Distinguished Performance Award for the Chancellor's Unit from N.C. State University. Lynch has worked for Sea Grant for seven years and has been an invaluable part of the Raleigh office.

Lynch developed a special method for handling grant processing for the National Sea Grant Program in Washington. The method was later adopted by Sea Grant programs in other states.

Fishing Forum

Can recreational fishermen have a say in how North Carolina's coastal fisheries are managed?

The answer to that question could come during the first N.C. Marine Recreational Fishing Forum, scheduled for Feb. 1 at the Jane S. McKimmon Center on the campus of N.C. State University in Raleigh.

The forum will inform the recreational fishing community about the latest developments in fisheries research and management, says Jim Murray, director of the Marine Advisory Service for the UNC Sea Grant College Program, a forum sponsor.

Leaders of groups that benefit from the recreational fishery will also be invited to participate in a forum in which they will voice the concerns of their peers, Murray says.

"This will not be a 'how to fish' meeting," Murray says. "It'll be an opportunity for recreational fishermen to become more aware of what's going on in how fisheries are studied and managed. Those are two subjects of vital importance to the future of the fishery resource in this state."

For information about registration, contact Murray at the Sea Grant office in Raleigh at 919/515-2454.

Back Talk A Forum for Coastwatch Readers

Coastwatch wants to hear from you on topics relating to the North Carolina coast. Letters should be no longer than 250 words and should contain the author's name, address and telephone number. Letters may be edited for style. Send all correspondence to Coastwatch, UNC Sea Grant, Box 8605, N.C. State University, Raleigh, NC 27695. Opinions expressed on this page are not necessarily those of UNC Sea Grant employees or staff.

Keeping the Coast Clean

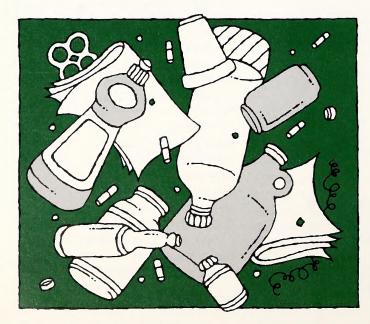
Dear Editor,

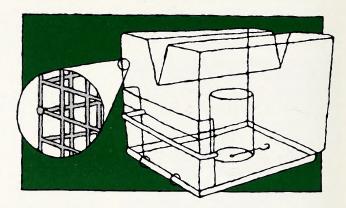
I really enjoyed my first "new" Coastwatch and look forward to many more years of being kept informed and enlightened. If you have a volunteer program in addition to the annual Big Sweep, I'd like more information about that and how to participate. You folks do a great job.

Candace Jackson, Raleigh, N.C.

The Big Sweep is more than a one-day waterway litter cleanup. It's a year-round educational outreach project as well, and there are a host of volunteer opportunities. In recent months, Big Sweep coordinators have held community education events such as "trash tournaments" in conjunction with sportfishing tournaments. We're sure these activities could benefit from extra hands.

Also, planning for the next Big Sweep, set for Sept. 19, 1992, is already under way. Throughout the year, especially in the months just prior to cleanup day, volunteers are needed to take phone calls, assist with mailings (i.e. stuffing envelopes) and help with other details. To find out how you can help, contact logistical coordinator Susan Bartholomew at 515-2454.





Cagin' Shrimp

Dear Editor.

In the early and mid-80s, I lived on Mill Creek in Pender County. At that time, I talked with Jim Bahen at Fort Fisher regarding research he was doing on a shrimp trap. I would love to know if he ever perfected the trap. I will be returning to the area for retirement soon and would love to catch a few shrimp off my pier. We enjoy your magazine.

Billie Hayden, Cincinnati, Ohio

Under a sampling permit from the N.C. Division of Marine Fisheries, Sea Grant marine agent Jim Bahen experimented a little with shrimp traps in the early 1980s. But he says he never had much luck catching shrimp in commercial quantities.

The trap was an 18-inch cube made of half-by-half hardware cloth with a V-type funnel entrance running along the length of the top side and a bait opening at the bottom. The most he ever caught in one "soak" or "set" (about 2 hours) was seven to eight shrimp, he says.

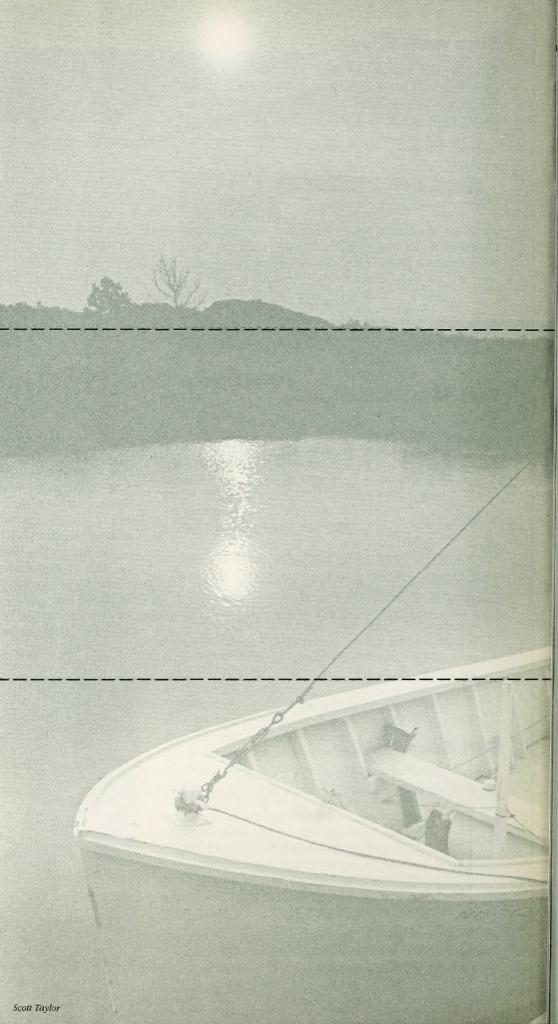
Bahen had hoped the traps might be a good way for sport shrimpers to get a pound or two without trawling. Also, he thought it might provide a means for commercial shrimpers to fish in secondary nursery areas closed to trawling.

Division of Marine Fisheries has approved regulations for commercial shrimp traps, but the required large mesh size limits barvest. Shrimp crawl in, then crawl back out, Bahen says. Any variation from that design requires a sampling permit, and the catch from this experimentation may not be sold.

Bahen says he never found the magic bait or technique in fishing the traps; other people he knows who have tried them have been closed-lipped about their findings. However, he thinks that with more time and study shrimp traps can be perfected. With a renewed emphasis on "passive" fishing gear, which doesn't destroy or disturb the bottom, there may be room for research in the future. Bahen envisions an ocean shrimp trap for rocky or coral bottoms inaccessible to trawling.

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The

Book Store

Publications to Enrich Your Coastal Library

Are you worried about Christmas gifts for that favorite recreational fisherman who has just about everything?

Try browsing the UNC Sea Grant bookshelves.

Sea Grant has a large selection of books and bulletins, all of which make wonderful stocking stuffers for the angler in the family.

KEEPING GEAR IN ORDER

Sportfishing Gear Maintenance is a two-page blueprint that advises fishermen about how to take care of rods and reels and other fishing equipment.

Any fisherman knows that well-kept gear can be crucial to landing the next big one. Best of all, it's free.

Write Sea Grant and ask for publication number UNC-SG-BP-81-1.

A BETTER DEAL ON A USED BOAT

Is your fisherman thinking about buying a used boat?

How to Buy A Used Boat is a publication that can give him or her all the information needed to make a wise selection.

What's the best type of boat to buy? What does a person look for when checking for defects and problems? What is a good price?

The answers can be found in How To Buy A Used Boat. Included is a checklist for evaluating small recreational boats and guidelines

for determining a fair price.

For your copy, send \$2 to Sea Grant. Ask for publication number UNC-SG-81-10.

A HANDY FISH REFERENCE

One of Sea Grant's most popular free publications is the Recreational Guide to Management of Fish in South Atlantic Waters.

It's a one-page guide crammed with current biological data on many popular species. It also includes the latest state and federal regulations for catching fish off the North Carolina coast.

Write Sea Grant and ask for a free copy of publication number UNC-SG-89-06.

SHRIMP IN **YOUR FREEZER**

Wouldn't it be nice to settle down for the winter with a freezer full of delicious Tar Heel shrimp?

A Guide to Recreational Shrimping provides detailed instructions for rigging small boats to catch these small crustaceans.

In 34 pages of advice and illustrations, this book shows how to build doors, choose nets, rig the boat and pull the

It's a real bargain at \$4. For your copy, write Sea Grant and ask for publication number UNC-SG-86-07.

STEP-BY-STEP **CRAB POTS**

Has your favorite fisherman ever built a crab pot?

It's more complictaed than it looks. Sea Grant's booklet. How To Build A Crab Pot is one of the best booklets available on the subject.

Learn the step-by-step procedures for assembling this sure-fire method for catching crabs. For your copy, send \$1.50 to Sea Grant and ask for publication number UNC-SG-80-03.

HARDBOTTOM DISTRIBUTION/ FISHING MAP

This 39"x27" poster is a guide to the natural offshore reefs (hardbottoms) between Cape Lookout and Cape Fear. These are prime fishing spots and can be located using the map's Loran grid. The flip side of the poster features five fourcolor paintings of the reefs. It also makes an excellent educational tool. For The Hardbottom Distribution/ Fishing Map, write to Sea Grant and ask for publication number UNC-SG-86-25. The cost is \$5.

ODD FISH? NOT NECESSARILY.

These 16 colorful pamphlets feature underutilized species from Gulf and South Atlantic waters. The Nontraditional Fish Brochures describe how to catch, clean and prepare the fish. Recipes are also included.

Series 1 covers amberiack, sea robin, skates and rays, triggerfish, panfish, jack crevalle, sharks, sheepshead, bonito and croaker. Series 2 covers black drum, bluefish. ladyfish, mullet, pigfish and sea catfish.

For your copies, send \$1 per series to Sea Grant and ask for publication numbers UNC-SG-85-09 through UNC-SG-85-18 (for Series 1) and publication numbers UNC-SG-86-13 through UNC-SG-86-18 (for Series 2).

THE NEW WAVE COOKBOOK

A fresh slant on preparing unusual fish is found in Recipes With a New Catch. This 40-page booklet is full of delicious recipes for cooking non-traditional fish - shark. triggerfish, bluefish, amberiack and more.

It's a catch for \$2. For your copy, write Sea Grant and ask for publication number UNC-SG-86-06.

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